SEPTEMBER 1987

THE INDIAN FORESTER

536/87

30-9-1987

Founded in 1875

Telegram :Indian Forester

Telephone : 27021/264

INDIAN FORESTER

(A Monthly Journal of Forestry and Forestry Research)

BOARD OF MANAGEMENT

Chairman—Y.G JADHAV. I.F.S., Inspector General of Forests, New Delhi.

Vice Chairman—R.V. SINGH, I.F.S., President, Forest Research Institute & Colleges, Dehra Dun.

MEMBERS

Andamans: S.S CHANA, I.F.S., Andhra Pradesh: K.V.S. BABU, I.F.S.; Arunachal Pradesh: S.B. ROY, I.F.S. Assam: D.P. NEOG, I.F.S.; Bihar: ANIRUDH TEWARY, I.F.S.; Dadar & Nagarhaveli: H.C. DHAWAN, I F S.; Goa: PANDEY B.P. SINHA, I.F.S.; Gujarat: M.N. VAISHNAV, I.F.S; Haryana: GURNAM SINGH, I.F.S.; Himachal Pradesh: I.S. KANG, I.F.S.; Jammu & Kashmir: SYED NOOR-UL-HASSAN I.F.S.; Karnataka: S SHYAM SUNDER, I.F.S.; Kerala: M SIVARAJAN, I.F.S.; Maharashtra: S.B. KULKARNI, I.F.S.; Madhya Pradesh: N.K. J SHI, I.F.S.; Manipur: B.S.K. SARMA, I.F.S.: Meghalaya: A. WAHLANG, I.F.S.; Mizoram: O.N KAUL, I.F.S.; Nagaland: D.K. ZELIANG, I.F.S.: Orissa: S C. PADHI, I.F.S.; Punjab: S.K. KAPUR, I.F.S.; Rajasthan: BHARAT SINGH, I.F.S.: Sikkim: P. S. MOKTAN, I.F.S.; Tamil Nadu: JOHN JOSEPH, I.F.S.; Tripura: M. SARKAR, I.F.S.: Uttar Pradesh: D.B. MISRA, I.F.S., West Bengal: P. GUHATHAKURTA, I.F.S.

RULES OF MANAGEMENT

1. *Pre-payable Annual Subscription* :—

INDIA (Inclusive of Postage)	FOREIGN	SINGLE COPY (Current and Back issue) (Exclusive of Postage)
Rs. 100.00.	£ 25 00 or $ 50.00 (By Sea Mail) £ 40.00 or $ 80.00 (By Air Mail)	India Rs. 10.00, Foreign $ 5.00 or £ 2.50

Note:—Subscriptions are generally booked for a Calendar Year (JANUARY-DECEMBER), and/or from JULY-JUNE. Copies for intermediate months (of current issue) can, however, be supplied on payment, if available.

2. *Concessional Rates of Annual Subscription* (Applicable to Serving Forest Officers & Forest Scientists in Government Institutes and Government Departments in India only) :—

(a) Those drawing a Salary of less than Rs. 500 p.m. ... ...Rs. 50.00 per Annum

(b) " " " " Rs. 700 " ... ...Rs. 60.00 " "

3. *Life Subscription*:—Forest Officers, on retirement from service in India, can obtain copies of the *Indian Forester* for life by one Single Payment of Rs. 300.00 or its equivalent. A life Subscriber will be enrolled as such hand entitled to receive copies of the Journal from the date of receipt of the full amount of his Life subscription Request for back numbers of the Journal will not be entertained. These can, however, be supplied if available, on payment fixed for back numbers.

4. *Advertisement Tariff*:—(The rates are exclusive of blocks, etc. and are liable to change WITHOUT NOTICE). All Advertisement Matter is strictly subject to the approval of the Management.

N.B.—The Table below shows Contract Rates for and over SIX and TWELVE Insertions respectively to be consumed in one YEAR or THREE Insertions booked at a time and printed in three successive Issue of the Journal. The figures in the right-hand column denote Charges for Casual and Single Insertions

Space	12 Insertions	6 Insertions	3 Insertions	Casual (Per Insertion)
Full Page	Rs. 1500.00	Rs. 800.00	Rs. 450.00	Rs. 150.00
Half Page	Rs. 900.00	Rs. 500.00	Rs. 300.00	Rs. 100.00
Quarter Page	Rs. 600.00	Rs. 350.00	Rs. 225.00	Rs. 80.00
2.5 cm Across Page	Rs. 500.00	Rs. 300.00	Rs. 200.00	Rs. 70.00

Note:—(1) Extra charges over the above Rates for *(a)* Multi-Colour Insertions (up to four colour only) 75% *(b)* Double-colour (Red only or Red and Black)—25%; *(c)* Advertisement on Art Paper—25%

(2) Half-tone and Line Blocks, Stereos, and Matrices accepted. Blocks of all description and/or other Advertisements material are to be supplied by the Advertising parties themselves.

(3) screen used for Advertisements : 80—100.

(4) Only one *Voucher Copy* will be supplied Overall Size : 24 cm × 18.5 cm; Printing Size (Full-page) 20 cm × 15 cm.

Important—*(a)* Advertisement charges are strictly Payable in advance preferably by a bank Draft on State Bank of India, Dehra Dun, U.P. (India); and drawn in favour of the Business Manager *Indian Forester* *(b)*, The Advertisement matter, which should be TYPEWRITTEN in BLOCK LETTERS or ITALICS, must reach us EIGHT WEEKS (10 WEEKS in case of multi-colour insertions) before the appearance of an issue for which an advertisement is intended, and should always be sent in DUPLICATE. For further particulars and of terms business please apply to the Business Manager. *Indian Forester*.

(5) Correspondence concerning subscriptions, etc., should be addressed to the Business Manager *Indian Forester*, P.O. New Forest, Dehra Dun (India). All payments on account of Subscriptions and Advertisement, etc., must, however, be made in the name of the Business Manager, *Indian Forester* and Cheques, etc., drawn in his favour.

(6) All complaints regarding delay in receipt or non-delivery of a copy or copies of the *Indian Forester*, should be made WITHIN 30 DAYS from the due date of publication of an issue which is 1st ofeach month to the Business Manager, *Indian Forester*, P.O. New Forest, Dehra Dun. Efforts will be made to supply duplicate copy or copies of the missing number, *free of cost*, provided a complaint is received in time. and on payment if a complaint as received after 30 days subject to the availability of a copy or copies in stock in their case.

(7) In case of dispute, Dehra Dun. U.P. (India), shall be the place of jurisdiction.

VOLUME 113 NUMBER 9

536/87

30-4-1987

THE
INDIAN FORESTER
SEPTEMBER, 1987

CHANGING CONCEPTS OF FORESTRY IN INDIA

G.P. MAITHANI
Director, Silviculture Research,
Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

India has maintained since 1864 the oldest scientific forestry policy in the world. Among the natural resources, forests are invaluable as they play a key role in the socio-economic progress of a country and welfare of human being. The increasing population and rapid pace of industrialisation have brought about a tremendous pressure on the forests. This has resulted in turning 175 million ha of our land into wastelands. The ecological imbalance and environmental degradation have upset the socio-economic fibres of our country and have caused serious environmental crises.

Forests and Forestry

In legal sense an area of land proclaimed to be a forest under a forest act or ordinance is termed as forest. This definition is not acceptable today to many non-foresters. The term forest conveys a sense of wood coverage consisting of land covered with trees, under wood and shrubs. Even open pasture lands are not being taken as forests. Going by legal definition our country has about 22.8% of area under forests. If we go by the peoples expectation of a forest contradictory figures are projected. Some feel that forests in terms of their imagination are hardly about 12% of the land area. It is felt that defining forests is still an unsolved exercise. Whatever may be the definition of forests, in evolution of life on the earth the human species owes its existence to a great extent to the forests. Forests are one of the vital resources on which man draws upon for fulfilling his various demands. The three basic resources the land, air and water are protected, conserved and developed by forests.

With time different activities in respect of forests came to be recognised as forestry. What precisely should be considered as forestry is no less debatable than the definition of forests. Historically speaking, exploitation of trees was probably the first forestry operation. Then exploitation supported by helping natural regeneration, tending and thinning forest stands were included in forestry activity Gradually artificial regeneration, protection, canopy manipulations, cultural operations, final

harvests etc., got added. In the good old days when foresters used to spend their lives in attending to various forestry activities the interests of non-foresters in forests were very limited. The educated elites and ruling class knew forests mostly for shikar and govt. knew it mainly for revenues. Exploitation was mostly for commercial, industrial and govt. supplies. The operations were confined to a very limited number of species.

Changing fashions in forestry

Forestry has now undergone a tremendous change in concepts. For simplicity to manage, easiness to harvest and uncomplicatedness of marketing uniform system was used to be liked most. Today the requirement is of greatest diversity in age and species. Now programmes are prepared on computers; a D.F.O. can tour his Division in one day; a working plan Officer does not require to pitch tents and for volume measurement a tree is not required to be felled. Paper is prepared from mixed pulp and timber with knots has more value. Days of slash disposal are gone. Worse, even a dry leaf is not left on the forest floor after exploitation.

Advent of scientific forestry

If exploitation is considered as forestry operation it was probably in existence from time immemorial. This forestry was practised by man for clearing land for cultivation, building houses, cooking food, meeting his various domestic demands and also for trade. When the population was low, peoples demand was limited and forests were in abundance, this parallel forestry did not become conspicuous. But as the exploitation of easily accessible areas pushed forests to remote areas, proportion of bigger size timber got reduced, forest area got reduced for cultivation, human population increased and pressure on forests increased, the shape of forestry went on changing. Forestry which is a term of general usage today had its birth in India with the advent of British Rule. In the early days of British Raj it was indiscriminate exploitation only as was the practice earlier. But gradually scientific forestry made its headway and concepts in forestry went on changing.

Modern concept of forestry

But inspite of the advent of scientific forestry destruction of forests went on unabatedly. Changes in rules, abolition of jamindaris, grow more food campaigns and increasing developmental activities accelerated the process of forest destruction. The result in due course was acute shortage of firewood, fodder, small timber and industrial raw material along with ecological and environmental degradation. As a result a different meaning is given to forestry today. Now forestry is thought in terms of protection, conservation, creation and development.

Till very recently the allocations to forestry sector were the lowest. Research and development in forestry were neglected items. This scene has since changed. Afforestation has come to be recognised as a major activity in forestry. In addition to the conventional plantation programmes massive plantation programmes in the form of Social Forestry, Wasteland Afforestation, Agro-forestry, Farm Forestry, captive plantations etc. have been launched. Now forestry is not confined to the Forest

Departments of State Govts. Many non-governmental organisations, private individuals, and institutions are also seeking to be involved in forestry in various ways. Basic aim of forestry now is ecological security and economic prosperity of the country.

Problems and Prospects

The indiscriminate felling of forests d unthoughtful transgression into forest s have today brought us to a level where vital resource is at the stage of ..haustion. Exploding population of human being and their domesticated animals have crossed the thresh hold levels. The excessive human and cattle population have over used the forest resource to such an extent that ecological catastrophes have been triggered. The extremes of climates, devastating floods, disappearing green mantle, depleting soils, dwindling productions, advancing deserts, drying water source etc., are manifestations of ecological imbalance. Pollution in a holistic sense is eating up man physically and spiritually.

With the depletion and degradation of ..tural resources by over use we are still lag-.g far behind in the process of development ..rough modernisation. Availability of the resources is generally much below the world averages and far below the averages of the developed countries. We do not have enough land space and the productivity of the available space, as far as forests are concerned, is also very low. As compared to the world average of 1.6 ha per capita we have only 0.11 ha per capita of productive forest area. As against the total world forest area of 29.1% our forest area with 15% of the world population has only 1% of total productive forest area. With about 22.8% land area of forests only 1.6% of gross domestic product is its contribution. The employment of rural population is only 0.2%. Mean annual increment is only 0.5 m^3 while the world average is about 2 m^3 per hectare. Of all the categories of need, which forests can supply most urgent is that of fuel. In this regard also against the requirement of 200 million tons our recorded production of wood is far below.

Ecologically the situation is very alarming. By 1984 we had lost about 4.3 million ha of forest area and annually .161 m ha area is estimated to be lost. 175 m ha of land of India has environmental problems. About 40 million ha of land is subject to periodic floods and this increases at the rate of 100% in a decade. 6000 m tons of top soil is lost every year and with this is lost NPK worth 700/- crores. This is with reference to the entire land area of the country.

Forestry for the people and by the people

The above state of affairs warrants immediate attention of all concerned. The task is so stupendous that simply govt. efforts would prove like a drop in the ocean. Moreover without public cooperation and participation we cannot be even in the proximity of success. In a democratic set up people, politicians and press matter the most. Govt. efforts also need to make the programme a peoples movement. Protection, conservation and development of environment cannot be dreamed of without involving people. The massive plantation programmes set forth for the country need everyone's active indulgence. Social forestry, agro-forestry and wasteland

development programmes are mainly the peoples programmes for ensuring ecological security and fulfilling the social and commercial needs of the nation. Involving the mass in protection, conservation and production will need high extension technologies.

Forestry now is at cross roads. There is awakening in the masses and there is political will to do some thing good. Funds are flowing in. We must give a suitable orientation to forestry. It is the onus of the foresters and forestry scientists to make best use of the prevailing situation and dedicate themselves to the cause of forestry. Foresters should identify their role properly.

We need to discard many jobs which do not need forestry skill, and assert ourselves where technical skill is involved. A forester has to be a skillful manager and effective leader. He has to be a man of masses. Foresters have to be extroverts.

Any amount of input in the form of money and research workers time will be at best wasted and at worst disastrous if scientists do not start by listening to the people they are trying to help, like farmers and villagers who have lived in the area for generations and by studying and understanding their traditional methods. For real progress to be made in improving the forests and then improving the productivity and usefulness of forests to meet the needs of the people, a true spirit of partnership is required between scientists and those who work on and live by forests.

Conventional forests not to be neglected

Conventional forestry practices also have a tremendous potential of production and employment generation. If the productivity level is maximised to 13.37 m^3 per ha per year, the production from 50 million ha potentially productive forest area, will be in surplus of our demands for many decades to come. In conventional forests wherever the climate permits it, concept of ecologically ideal four tier forests will have to be developed i.e., large size tre canopy, small size under storey, shrub str and ground flora of grasses and h We will have to work out suitable mi and densities for such forests. The later and vertical space will have to be utilized to the maximum.

Research needs and methodology

Research for plantation forestry both for conventional and non-conventional forests needs concerted and intensive efforts. We will have to prepare economically viable models of multipurpose tree, shrub, herbs and grass culture for private forestry. Marginal uneconomical holdings can be put to forestry use only by giving suitable technologies and economically viable models. Forestry has the potential supporting rural economy directly and directly As far as hills are concerned forestry can support 90% of the rural economy. For this production patterns and management techniques will have to be evolved. Skills of local people will have to be developed in their traditional crafts. Raw materials for village cottage industries will have to be grown. Tackling the ecologically degraded lands, producing maximum in minimum time and space, bridging the gap between demand and supply, increasing productivity of the conventional

forests, etc. are some of the items of top priority. In these forester will certainly need the help of forestry scientist. Both should be complementary to each other in developing forestry. Silviculture, soil science and Genetics are the most important subjects of research. Basic research and applied research will have to go on simultaneously. In the present day context we have a huge back log in both of these.

Research has to be of field utility. For this identification of the needs of the people will be needed. Scientific research can never be an end in itself. It must always have as its objective the satisfying of human needs, directly or indirecly, perceived or as yet unperceived by the beneficiaries. It is a sad fact of our modern life that specialisation, often minutely focussed and intensely concentrated, while bringing scientific and technological advance, unprecedented in the history of mankind, can fail disastrously in human terms. Narrowness of vision and understanding can mean that a breakthrough in laboratory leads to a breakdown or at least a let down, for the people who should be benefited.

These days two extreme thinkings are in vogue. One school of thought is very exploitative and the other very conservative. As far as resource is concerned both are undesirable. We should be able to give optimal levels of resource utilisation. We should preserve the green glory of the nation and strengthen the hope of survival in these perilous times.

The changing concepts are being developed mostly on the basis of needs. But there is something pious and eternal about forests and forestry. A befitting and more pervading definition of forests will enable forestry to maintain these characters. Such definition will also save forests and forestry from the frequent changing out look towards them. Forestry has suffered tremendously from the fanciful thinkings and motivated misdirectionalism. Probably following definition may be more appropriate :

"A forest is a complex system of Abiotic and Biotic components in constant dynamic equilibrium. Superficially it may be known by the presence of trees, shrubs, herbs, grasses, climbers and animal life. The function of a forest is to create, conserve and develop life. Here life includes all forms of life. If these functions are fulfilled then only an area is fit to be called a forest. All operations to create, conserve and develop forest for discharging the prescribed functions can be termed as forestry".

SUMMARY

This paper deals with the existing forestry problems in the country and the deleterious effect on the over all efficiency and productivity of the forestry sector. The changes towards improving the efficiency of forests have been suggested. A difinition for forests and forestry has also been offered.

भारत में वानिकी की बदलती हुई धारणाएँ

जी०पी० मैठाणी

सारांश

इस अभिपत्र में देश की वर्तमान वानिकी समस्याओं तथा वानिकी क्षेत्र की सर्वांग कार्यदक्षता और उत्पादकता पर उनके हानिकर प्रभाव की विवेचना की गई है। वनों की कार्यदक्षता में सुधार लाने वाले परिवर्तन सुझाए गए हैं। वन और वानिकी की नई परिभाषाएँ भी इसमें प्रस्तुत की गई हैं।

References

Bahuguna, V.K. (1986). Research Needs of Tropical Rain Forests of India, *Indian. For.* **112** (12) : 1049-1057.

Chandrashekharan, C. (1983). *Unasylva* 35 (142).

Maithani, G.P. (1986). Editorial, *Indian For* **112** (7).

Wickens, G.E , J.R. Goodin and D.V Field (1985). Plants for Arid Lands.

———

HERBACEOUS UNDERGROWTH IN SOME FOREST HABITATS IN NILGIRIS

RASHMI RAJVANSHI, VIJAI KUMAR, WAMAN BACHPAI, K. RAJAGOPAL
AND S. FRANCIS HILARY RAJ

Environmental Research Station, Ootacamund (Tamil Nadu)

Introduction

Proper undergrowth in a forest is essential for maintenance of nutrient status, ecological balance, wildlife habitat and hydrological balance of any forest ecosystem (Mathur & Soni, 1983). The quality and quantity of undergrowth depends upon the tree canopy and edaphic and microclimatic conditions existing under the particular type of forest. In Nilgiris, different types of forest occur, e.g. natural Sholas, plantations of *Eucalyptus globulus* Labill (Bluegum), *Pinus patula* (Ponderosa pine) etc. *Eucalyptus* plantations are considered to inhibit undergrowth, particularly of grass in forest floor. The present paper is an attempt to analyze the qualitative and quantitative aspects of herbaceous undergrowth under natural Shola forests, *Eucalyptus globulus* and *Pinus patula* (Kumri land) plantations.

Site description

The study area is located in district Nilgiris, Tamil Nadu. The observations were taken at Osamund experimental watersheds (2134 m above MSL : longitude 76°31′ 15″ and latitude 11°26′ 10″) of Environmental Research Station, Ootacamund.

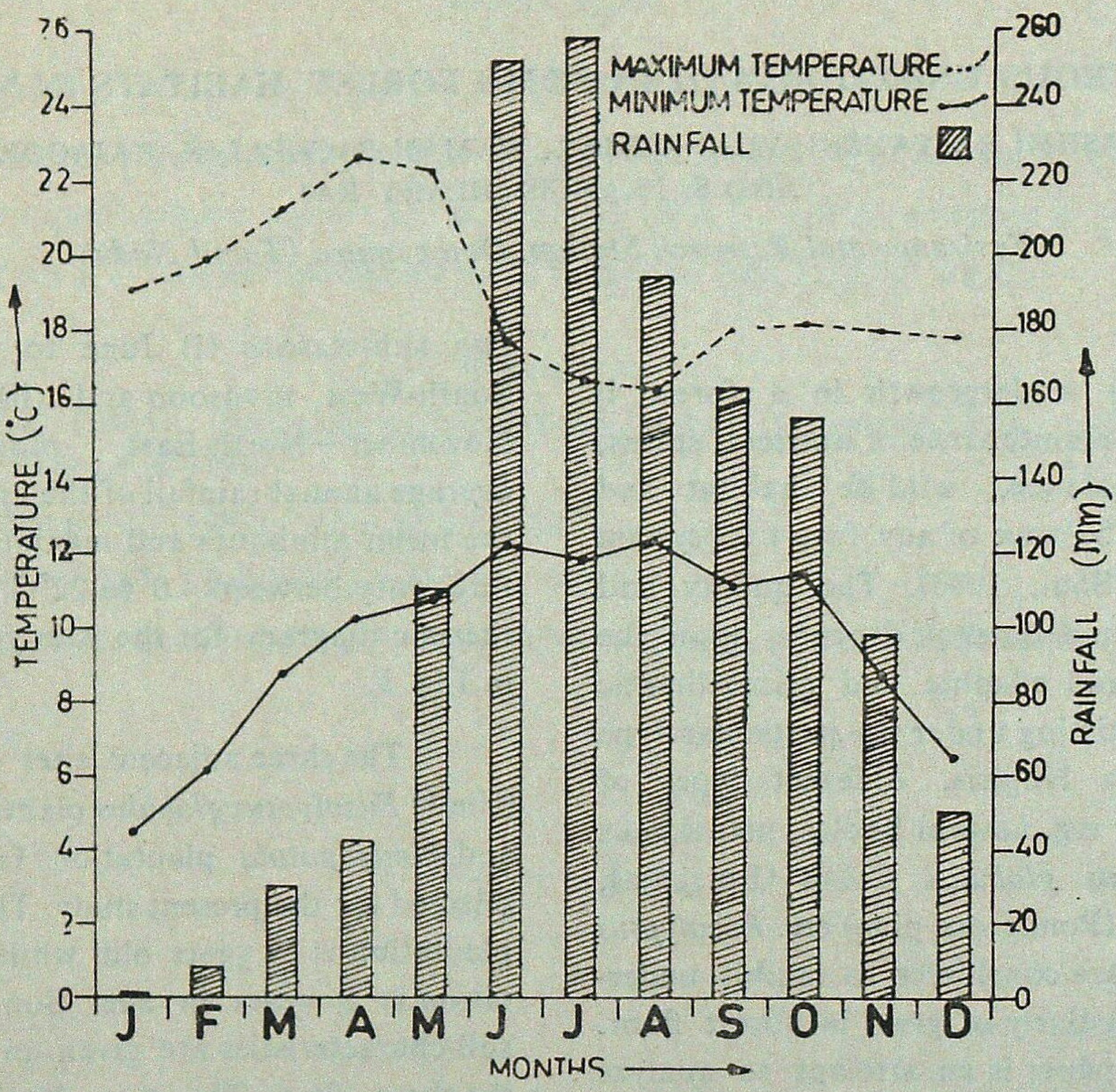
The climate of the area is temperate with three distinct seasons i.e. Summer (March to May) Rainy season (June to November) and Winter (December to February): the rainy season is divisible into two sub-seasons (i) June to September—South-West monsoon and (ii) October to November—North-East monsoon. The average annual rainfall of the area is 140 cm; the mean minimum and maximum temperatures vary between 4.0 to 22°C. An ombrothermic diagram for the study area is given in Fig. 1.

The three adjacent sites Shola forest (site I) *Eucalyptus globulus* plantation (site II) and *Pinus patula* plantation (site III) were selected for the present study. The *Eucalyptus* plantation is 27 years old while *Pinus* plantation is 8 years in age. Some important soil characteristics are given in Table 1 for the three sites. The tree density in Shola forest is 1200 trees/ha, in Bluegum 2275 trees/ha, in pines 1600 trees/ha. The shrub layer is completely absent in *Pinus* plantation; In Bluegum it is represented by *Euphatorium glandulosum*, *Ulex europeus*, *Cytisus scoparius* with a density of 9500 stems/ha. The shrub layer in Sholas is poorly developed, however the understorey formed by the seedlings of various trees and lianas has a density of 900 stems/ha.

Methodology

The herbaceous undergrowth was studied for phytosociological characters using 'Quadrat Method'. Ten quadrats of 1 m × 1 m size were sampled randomly during the month of September, 1985, in

Fig. 1



Ombrothermic diagram of the study site based on the year 1979-84.

Table 1

Some physico-chemical characteristics of the soils of three sites

Characteristics	Site I (Shola)	Site II (*Eucalyptus*)	Site III (*Pinus*)
Pore space (%)	56.15	52.69	50.00
PH	6.22	5.65	5.55
Organic carbon (%)	5.8	2.8	1.9
Electrical conductivity (μ mhos cm^{-1})	233.9	38.6	87.7

each site. All the species encountered were identified, number of plants were counted and diameters of some plants of each species were noted. The values of frequency, density were calculated according to Curtis and Cottam (1956) and the basal area of plants was calculated as defined by Oosting (1958). Importance Value Index (IVI) was calculated according to Mueller-Dombois *et al.* (1974).

The biomass was estimated by 'Harvest plot method'. 5 plots of 1 m×1 m were harvested in month of September, which is considered as peak growth season of herbaceous undergrowth. The harvested material was separated into grasses and forbs manually, oven dried and weighed.

Statistical analysis was performed for standard error and 't' test using the method given by Snedecor and Cochran (1967).

Results

(i) *Phytosociology of undergrowth*: The undergrowth was studied for frequency, density, Basal area and IVI. Table 2 includes the enlisting of species, frequency, density, relative basal area and IVI of all the species on the three sites. The total number of species recorded on various sites was 33 on site I, 30 on site II, 14 on site III. Out of 33 species on site I, 7 are grasses, 3 sedges, 3 ferns, 2 bryophytes and 18 are forbs. On site II, 7 grasses, 1 sedge, 1 fern, 1 moss, and 20 forbs constitute the 30 species. The 14 species on site III are constituted by 3 grasses, one bryophyte and 10 forbs.

When compared for similarity in species composition using similarity index, the sites I and II were with lowest similarity (11.1%), site I and III were with 14.8% similarity while sites II and III have 48% similarity. Only three species i.e. *Andropogon foulkesii*, *Euphatorium glandulosum* and *Oxalis corniculata* were found common to all the three sites.

Under shola forest *Isachne australis* and *Droguetia diffusa* form the dominant and codominant plants. In bluegum plantations *Ischaemum ciliare* and *Eragrostis nigra* are two major species *Hypocharis glabra* and *Euphatorium glandulosum* are the dominant and codominant plants in *Pinus* plantations. When density, relative basal area and IVI of grasses, forbs and lower plants (Table 3) were compared it was found that the grasses were dominant in Bluegum plantations, while forbs were more in other two sites. Relative basal area and IVI also showed the same trend.

(ii) *Biomass*: The maximum biomass of undergrowth was recorded under bluegum plantations (Table 4). Grasses contributed more biomass in bluegum plantation, while biomass of forbs was more in other two sites. When analysed for significant difference using 't' test it was found that biomass was significantly different on all the three sites ($P<0.01$). 't' values are given in Table 4.

Discussion

The present study reveals the richness of natural Shola forest undergrowth in terms of species composition as compared to *Eucalyptus* and pine plantations. Also the species composition is quite different under sholas as is indicated by very low similarity indices between site I & II and I & III. Sholas are the natural forests of Nilgiris,

Table

Phytosociological data for plant

Name of plant species	Site I			
	Frequency (%)	Density	RBA (%)	IVI
1	2	3	4	5
Forbs				
Anaphalis travancorica Sm.	—	—	—	—
Anemone rivularis Ham.	—	—	—	—
Anotis monosperma B & HK.f	20	0.4	0.22	2.13
Berberis tinctoria Lesch.	10	0.1	0.53	1.44
Cardamine africana L.	30	2.5	3.77	7.26
Centella asiatica Urb.	—	—	—	—
Commelina clavata Cl.	—	—	—	—
Crotallaria calycina Schr.	—	—	—	—
Curculigo orchiodes Gaertn.	—	—	—	—
Cytisus scoparius L.	—	—	—	—
Desmodium scalpe D.C.	30	4.9	0.5	4.82
Dichrocephala chrysanthemifolia D.C.	—	—	—	—
Droguetca diffusa Wedd.	100	46.1	5.68	30.23
Erigeron mucronatus D.C.	—	—	—	—
Euphatorium glandulosum H.B. & K.	30	1.2	1.59	4.64
Fragaria nilgirensis Schddl	—	—	—	—
Gentiana quadrifaria Cl.	—	—	—	—
Gnaphalium hypoleucum D.C.	—	—	—	—
Hydrocotyle conferta W.	70	12.7	2.82	13.31
Hypochaeris glabra L.	—	—	—	—
Impatiens acautis Arn.	60	10.9	2.23	11.23
Justicia simplex D. Don	—	—	—	—
Leucas suffruiticosa Benth.	—	—	—	—
Myriactis wightii D.C.	70	3.7	8.70	16.10
Oxalis corniculata L.	30	1.2	0.24	3.29
Pepromia reflexa A. Dielr.	10	0.2	0.01	0.96
Pilea trinervia W.	30	3.5	2.21	6.05
Pimpinella pulneyensis Gamb.	—	—	—	—

(*Contd...*)

2

species of undergrowth in three sites

Site II				Site III			
Frequency (%)	Density	RBA (%)	IVI	Frequeney (%)	Density	RBA (%)	IVI
6	7	8	9	10	11	12	13
20	1 2	0.31	2.67	—	—	—	—
20	0.7	0 08	2.28	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	10	0.5	0.81	4.52
20	0.5	0.96	3.09	—	—	—	—
10	0.1	0.2	1.03	—	—	—	—
70	2.4	0.73	7.81	50	1.5	3.24	20.04
10	0.1	0.11	1.12	—	—	—	—
—	—	—	—	—	—	—	—
30	0.5	0.12	3.23	10	0.2	0.15	3.35
—	—	—	—	—	—	—	—
10	0.1	0.07	1.1	—	—	—	—
100	7.7	2.27	14.74	60	7.1	15.60	44.88
—	—	—	—	10	0.1	0.47	3.50
30	0.7	0.08	3 26	10	0.1	0.10	3.13
20	3.8	0.19	3.46	—	—	—	—
—	—	—	—	—	—	—	—
80	23 7	20 65	36.69	50	4.6	69 32	91.47
—	—	—	—	—	—	—	—
20	7.9	0.6	5 29	—	—	—	—
20	0.3	0.12	2.29	—	—	—	—
—	—	—	—	—	—	—	—
70	10.7	0.45	10 41	30	0.9	0.08	10.19
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
20	1.1	0.05	2.39	—	—	—	—

1	2	3	4	5
Polygonum chinense L.	10	0.1	0.02	0.93
Polygonum punctatum Buch. Ham.	—	—	—	—
Ranunculus wallichianus W & A	—	—	—	—
Rubia cordifolia L.	10	0.2	0.17	1.02
Rubus racemosus Roxb.	20	0.2	0.45	2.29
Sanicula europaea L.	50	4.2	6.06	11.88
Scutellaria violacea Heyne.	40	4.9	1.77	6.96
Smilex zeylanica L. (S.)	10	0.3	0.4	1.02
Solanum sisymbrifolium Lam.	—	—	—	—
Stellaria media L.	—	—	—	—
Grasses & Sedges				
Andropogon annulatus Forsk.	—	—	—	—
Andropogon foulkesii HR.f	30	16.9	10.67	19 9
Carex filicina Nees	30	3 4	3.79	7.58
Carex nubigena Don	20	3.1	0.16	2 99
Eragrostis nigra Nees.	—	—	—	—
Eragrostis tenuifolia Hochst.	—	—	—	—
Festuca bromoides H.B. & K.	60	12.9	10 57	20.25
Isachne australis H K.f.	70	46.6	25.45	47.54
Isachne elegans Dalz	10	0.2	0.17	1.12
Isachne kunthiana W.A.	70	18.5	0.79	13.25
Ischaenum ciliare Retz.	—	—	—	—
Oplismenus compositus Beauv.	10	1.0	0.42	1.64
Oplismenus undulatifolius Hook f.	60	5.3	1 52	8 6
Panicum prostratum Lamb.	—	—	—	—
Pycreus uniloides Dom.	—	—	—	—
Scirpus mucronatus L.	10	1.0	0.55	1.7
Tripogon bromoides Roth.	—	—	—	—
Lower Plants				
Asplenium brasiliense	20	0.3	0.37	2 22
Bryum spp.	50	44.7	2.38	22.06
Pteris aquilina	10	1.5	0.37	1.76
Pteris cretica	20	0.4	0.45	2.64
Mosses	30	39	0.27	16.25

RBA — Relative Basal Area. IVI — Importance Value Index.

6	7	8	9	10	11	12	13
—	—	—	—	—	—	—	—
30	2.3	0.1	3.83	—	—	—	—
10	0 1	0.07	1.08	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	10	0.1	0.09	3.12
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
10	0.2	0.12	1.17	—	—	—	—
30	3.9	0.09	4.38	30	13.5	2.31	33.90
40	23.3	5.43	17.42	—	—	—	—
20	8.2	0.93	5.73	20	6.6	3.97	20.96
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
90	60.3	16.55	46.26	—	—	—	—
40	3.8	0.77	6.01	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	10	2.9	0.63	8.45
100	100	48.21	92.64	40	9.9	2.99	31.34
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
10	0.6	0.23	1.43	—	—	—	—
10	0.2	0.12	1.17	—	—	—	—
—	—	—	—	—	—	—	—
40	6.8	0.29	6.56	—	—	—	—
20	0.4	0.42	2.52	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
20	17.2	0.19	8.11	10	10.5	0.25	26.77

Table 3

Density, Relative Basal area and percentage of IVI of Different categories of plants in three sites

Plant Categories	Site I			Site II			Site III		
	Density (plants/ m^2)	Relative Basal area (%)	% IVI	Density (plants / m^2)	Relative Basal area (%)	% IVI	Density (plants/ m^2)	Relative Basal area (%)	% IVI
Grasses and Sedges	92	58.99	41.55	207	74.27	58 6	19	7.59	20.25
Forbs	114	37.14	43.58	68	25.11	37.86	28	92.17	70.83
Lower plants	86	3.87	14.87	18	0.62	3.54	11	0 24	8.92

Table 4

Biomass ($kg\ ha^{-1}$) of herbaceous undergrowth in the three sites

Categories	Biomass ($kg\ ha^{-1}$) ± 1 S E.		
	Site 1	Site II	Site III
Grasses	191.3 ± 24.2	998.6 ± 65.3	12.7 ± 1.20
Forbs	254.5 ± 31.8	236.6 ± 25.8	41.0 ± 7.75
Total	445.8 ± 55.7	1235.2 ± 48 4	53.7 ± 8 85

't' value for total Biomass : Site I & II = 10.7, Site I & III = 6.0, Site II & III = 24.01.

which developed as climatic climax in this area through thousands of years (Champion & Seth, 1968). These forests have a rich and a typical species composition explaining the large dissimilarity between these and other forest types, phytosociologically.

The lower plant density under Sholas and pines as compared to bluegum could be explained as due to modification of microclimatic conditions by the canopies. The tree canopy is continuous in pines and Sholas, while it is with large gaps in bluegum plantations, which results in difference in availability in sunlight for undergrowth. Proper sunlight enhances the growth of plants under *Eucalyptus*.

Undergrowth biomass for bluegum falls under the range of biomass reported for various Indian tropical forests (986 to 2000 kg ha^{-1}) by Singh and Singh (1980). However, the production of biomass under Shola and pines is low. The sholas are restricted to subtropical or temperate belt of South Indian Hills and no comparative study on herbaceous undergrowth is available for these forests. The Ponderosa pines are practically unable to support good undergrowth in these climatic conditions. This may be due to the presence of thick layer of litter on forest floor which inhibits the seed germination of other species, along with the complete shade provided by these trees.

The high species diversity alon gwith the high biomass of undergrowth under *Eucalyptus* is in contrast to common prevailing view that these trees cannot support the proper undergrowth as the leaf litter of *Eucalyptus* has a toxic effect (allelopathic) on germination of other plant species. However, it could be assumed that under high rainfall coditions, the toxicity of chemicals, perhaps, become diluted and thus in the regions above 1000 mm rainfall, the allelopathic effects become minimized. Mathur and Soni (1983) also showed higher species diversity in *E.* hybrid forests as compared to natural *Shorea robusta* forests in Doon Valley (rainfall *ca* 2000 mm). They suggested that under proper management conditions, *Eucalyptus* forests can provide sufficient protection to forest floor. In present study, higher biomass of grasses under *Eucalyptus* is suggestive of these forests serving as grazing lands to some extent under proper management conditions. While Sholas are the prime ecosystems in protection of species diversity and site characteristics, the bluegum plantation could support a luxuriant undergrowth especially for grasses.

Acknowledgements

The authors are grateful to Dr. R.V. Singh, President, Forest Research Institute and Colleges, Dehra Dun for affording necessary facilities to carryout these studies and for his guidance and suggestions. The authors are thankful to Dr. B.K. Subba Rao, Co-ordinator, Environmental Research Stations, Forest Research Institute for his continued interest and encouragement in the activities of the Research Centre. The authors are thankful to Shri G. Chevanan, Tracer for drawing; and to other staff of the Centre who assisted in the study.

SUMMARY

The herbaceous undergrowth under natural sholas was found qualitatively most rich and with unique species composition. *Eucalyptus* plantations supported a good undergrowth both qualitatively and quantitatively, while pines have much less undergrowth. A good grass cover was found under *Eucalyptus* with a biomass of 998.6 $\pm$ 65.3 kg ha^{-1}; the total biomass (kg ha^{-1}) of herbs under the three forest covers were 445.8 $\pm$ 55.7 (Sholas), 1235.2 $\pm$ 48 4 (*Eucalyptus*) and 54.7 $\pm$ 8.85 (pines).

नीलगिरि प्रदेश के कतिपय वन प्राकृतावासों की शाकीय अधोवनस्पतियां

रश्मि राजवंशी, विजय कुमार, वामन बाछपई, के० राजगोपाल व एस० फ्रांसिस हिलेरी राज

सारांश

प्राकृतिक शोला वनों में उग रही शाकीय अधोवनस्पतियां गुणात्मक विचार से बहुत सम्पन्न और विलक्षण जाति रचना की पाई गई। युकेलिप्टस रोपवनों में गुणात्मक और परिमाणात्मक दोनों दृष्टियों से अच्छी अधोवनस्पतियां उग रही हैं जब कि चीड़ वनों में अधोवनस्पतियां इससे बहुत कम हैं। युकेलिप्टस वनों में घास का आवरण भी था जिसका जैव पुंज 998.6 $\pm$ 65.3 किग्रा० हैक्टे०-1 था। तीन प्रकार के वनों में शाकों का कुल जैव पुंज (किग्रा० हैक्टे०-1) 445.8 $\pm$ 55.7 (शोला वन), 1235.2 $\pm$ 48.4 (युकेलिप्टस वन) और 53.7 $\pm$ 8.85 (चीड़ वन) पाया गया।

References

Champion, H.G. and S.K. Seth (1968). *The Forest types of India*, Govt. of India. Manager of Publications, Delhi.

Curtis, J.T. and G. Cottam (1956). *Plant ecology workbook, Laboratory field reference manual*, Burgess Publ. Co., Minnesota.

Mathur, H.N. and P. Soni (1983). Comparative account of undergrowth under *Eucalyptus* and Sal in three different localities of Doon Valley. *Indian For.*, **109** (12): 882-890.

Mueller-Dombois, D. Ellenberg, and H. Ellenberg (1974). *Aims and methods of Vegetation ecology*, Willey, New York.

Oosting, H.J. (1958). *The study of plant communities*. W.H. Freeman and Co., San Fransisco.

Singh, K.P. and R P. Singh (1980). Biomass and net primary production of herbaceous layer in tropical dry deciduous forest at Varanasi. *Trop. Ecol.* 21 : 47-58.

Snedecor, G. and W.G. Cochran (1967). *Statistical Methods*. Oxford and IBH publishing Co., New Delhi.

———

EFFECT OF CLEAR-FELLING OF CONGESTED CLUMPS ON YIELD OF BAMBOO (*DENDROCALAMUS STRICTUS*)

RAM PRASAD

Director,
State Forest Research Institute, Jabalpur (Madhya Pradesh)

The productivity in bamboos is assessed by the number of new culms produced annually. At a given site the production of new culms is mostly dependent on the culms of the previous year, the degree of congestion and the clump age. In a cleaned and thinned clump new culms grow not only on the periphery but throughout the clump, even in the middle. The clumps which are unduly large and congested usually contain a great proportion of dead, broken and malformed bamboos which are not merchantable (Prasad, 1986). They are removed from the clumps and left in the forest to rot thereby increasing fire hazard. Systematic working of such congested clumps also presents many other practical difficulties. It has been experienced that clumps containing more than 60 culms at the time of working are not easy to work and proportion of unmerchantable culms is also likely to be higher due to congestion and other adverse biotic pressures. In view of the difficulties in working of congested clumps many a times, heavier fellings are resorted to. When clumps are congested they produce a fewer new culms because of lack of growing space. Whatever new culms appear in the year ultimately get twisted and entangled with the old ones. For such congested clumps, therefore, clear-felling appears to be the only solution. However, no study appears to have been done on the possible productivity of bamboos in the event of their being clear-felled. In order to evaluate the effect of clear-felling of such congested clumps on new culm recruitments and annual productivity an experiment was taken up in Shahdol Division of Madhya Pradesh. The results of this study have been reported in this paper.

Materials and Methods

The present experimental site was taken up in Khannodi Range (Comptt. P-313) of North Shahdol Forest Division in the year 1977. This area lies along Rewa-Shahdol P.W.D. road near Semera village (335 m above msl). The total area of the experimental plot is 0.1369 ha. The area receives annual rainfall varying from 1070-1400 mm. The underlying sedimentary rocks covered by well drained sandy loam soils are found in the area. Mixed deciduous forests with site quality IV-B (representing height class 9-12 m) are met with. However, at the experimental sites there were no trees left as the site was being prepared for planting of tree species under social forestry scheme.

The congested clumps were clear-felled in March 1977 and debris and other unsaleable material was burnt *in situ*. The area was visited in December, 1980 for demarca-

tion of sample plot and enumeration of clumps which had established after clear-felling done about 4 years ago. There were 44 clumps in the sample plot which contained current year's culms (Karlas) and 1-3 years old bamboos (Mahila and Pakias). These clumps were then worked as per the prescribed bamboo working rules. The mean height of clump was recorded to be about 6 m which according to the prevalent site quality could be classified as bamboo quality-III. The felling cycle is 4 years. The main cutting rules provide for the retention of all current year's culms *Karlas* and 1 year old culms-*Mahilas*. Further, 1 year and 2-3 years old bamboos equal to the number of current year's new recruits are to be retained In any case, 10 culms (includingall current year's recruits) are to be retained in each clump. The harvested culms were then weighed for fresh and subsequently for air-dry weight. The area was ag in visited in 1982, 1983 and 1984 for enumeration of the culms in each clump. Final enumeration and harvesting was done in 1984. The results have been discussed in this paper.

Results and Discussion

The clear-felling of congested clumps in 1977, happened to be done at the fag end of the life cycle of bamboo of this area. This was the inference drawn from the fact that gregarious flowering started in 1983 and was completed in 1984, the year coinciding with the second felling cycle (after clear-felling). Thus only two felling cycles viz., 1980 and 1984 were possible. The bamboo culms (basal girth and length-wise) harvested in 1980 have been presented in Table 1. Similarly, the recruitment of culms, the number removed during felling and those retained at the time of felling have been shown in Table 2.

Year-wise recruitment of new culms and maturing of the newly recruited culms year after have been summarized in Table 3. Similarly, the size-wise bamboo obtained from working in first felling cycle have been condemed in Table 1-2. Comparative yield figures in two successive cycles of 4 years each have been presented in Table 4.

After clear-felling in 1977, clump formation was observed in 1980 when 44 clumps were enumerated in an area of 0.1369 hectares (321/ha). However, of these 44 clumps only 33 (241/ha) developed into exploitable size but remaining 11 clumps (80 clumps/ha) were found to be unexploitable. Accordingly, well grown and mature culms were harvested from fully developed 33 clumps. However, the underdeveloped 11 clumps were enumerated for the number of current year's and one year old culms (Table 2). There were 230 new culms recruited in 33 clumps (6.97/clump) and only 17 new culms in the remaining 11 clumps (1.54/clump). The fully developed 33 clumps contained 946 culms (28.97/clump) as against only 59 (5.36/clump) in still-developing 11 clumps. The exploitation of mature culms was therefore, confined to only 33 fully developed clumps from which 431 culms (13 06/clump) were cut and 515 culms (15 6/clump) were retained. Among the retained culms were 230 current year's culms 275 1-year old culms and 10 older culms. Thus, the harvested culms were older than 2-3 years which shows that recruitment of healthy culms started in the following rainy season (July-October 1977) after clear-felling. New culms were observed

Table 1

Production of Bamboo from harvesting of 4-years old clumps (Girthwise and lengthwise)

Basal girth class (First inter-node) (cm)	Length class-wise no. of culms harvested					
	Upto 2 (m)	2-3 (m)	3-4 (m)	4-5 (m)	5-6 (m)	Total
04 – 08	40	—	—	—	—	40
08 – 12	—	181	115	75	04	375
12 – 15	—	—	—	07	08	15
above 15	—	—	—	—	01	01
Total	40	181	115	82	13	431

Worked clumps : 33 (fully developed) Unworked clumps : 11 (unexploitable)

Table 2

No. of culms retained in each clumps after harvesting

No. of culms	Recruitments of current year	1-year old culms	2-3 years old culms	No. of culms retained	No. of culms cut	Total	Mean recruitments per clump
33-worked	230 (6.97)	275 (8.33)	10	515 (15 6)	431 (13.06)	946	28.87
11-worked	17 (1.54)	42 (3.82)	—	59 (5 36)	—	59	05.36
Total 44	247	317	10	574	431	100.5	
Mean	5.61	7.20	0.3	13.04	13.06		

Figure in parentheses are number of culms per clump.

Table 3

Annual recruitment of culms

Year	No. of clumps	Current years	1-year old	2-4 years old	Total	Mean no. per clumps
1980	33	230 (6.97)	275 (8.33)	441 (13.36)	946	28.70
1981	33	247 (7 48)	317 (9.61)	377 (11.42)	941	28.65
1982	43	206 (3.20)	253 (5.88)	446 (10.37)	905	21.00
1983	42	208 (4.95)	165 (3.92)	608 (14.47)	981	23.38
Mean	37.75	222.75	252.50	468.00	943 25	
		(5.65)	(6.93)	(12.40)		

Figure in parenthesis denotes the no. of culms per clump.

Table 4

Comparative yield in two felling cycles before gregarious flowering

Particulars	Figures in the year	
	1980	1984*
No. of culms	44	42
No. of developed culms available for exploitation	33	42
Total annual culm recruitment	946	981
Mean annual culm recruitments	236.50	245.25
Mean annual recruitmens per clump	7.17	5.84
Yield obtained (t/ha)	4.50	3 58
Yield obtained t/ha/year	1.12	0.90

* Gregarious flowering in 1983 resulted in drying of culms and therefore, recruitments pertained to 1982 and 1983.

after 4-months after clear-felling. Appearance of new culms was observed in adjoining sample plot-2 (0.105/ha) which was clear-felled in January 1980. There were 25 clumps before clear-felling and all of them started producing new culms in the ensuing rains. There were 25 clumps (240/ha) enumerated in December 1980 i.e., after one year of clear-felling. In the very first year of formation there were 238 new culms (Table 5).

The critical analysis of data in Table 5 indicates that though the clump formation was observed in a short period of 6 months after clear-felling, majority of the clumps (68%) contained less than 10 culms/clump. A minimum of 3 culms and a maximum of 28 culms (average 9.52 culms) in a clump were observed.

Analysis of data in Table 3 and 5 indicates that in the first year after clear-felling the clumps were still in the process of establishment and therefore, the majority of them contained less than 10 culms. This number increased to more than 28 in about 4 years time. This is quite possible that the size of clump may be bigger in the early period of the life cycle of *Dendrocalamus strictus*. In the present case the clumps must have been quite old (25-30 years old) as gregarious flowering was observed after about 7 years of clear-felling. The decline in yield from 4.50 t/ha in 1980 to 3.58 t/ha (Table 4) in 1984, also showed decline in the vigour of clumps. It is also to be noted that the yield of 4.50 t/ha was obtained from normal working while 3.58 t/ha was obtained from clear-felling done as a consequence of gregarious flowering.

Apart from the fact that the declining

Table 5

Development of clumps one year after clear-felling in sample Plot No. 2

No. of clumps	Size of clump (no. of culm in each clump)	Total no. of culms	No. of culms per clump	Per cent clumps.
10	Upto 05	37	3.70	40 00
07	06 — 10	57	8.14	28.00
04	11 — 15	48	12.00	16.00
01	16 — 20	19	19.00	04.00
01	21 — 25	23	23.00	04.00
02	26 — 30	54	27.00	08 00
Total 25 Mean	—	238	9.52	100.00

Clear-felled in January 1980, Recruitment observed in July-September 1980, Enumerated in December 1980.

trend of recruitment and yield was attributable to the old age of clump, the site quality of bamboo also makes an impact. The study areas discussed in this paper belong to bamboo site quality III. In a site quality I area of Balaghat Division, the extent of annual recruitments in 3 felling cycles (12 years) between 1948 to 1960 were analysed (Dutta and Tomer, 1964; Anon., 1970). While there were 4,975 new culms (current years recruits) in first felling cycle (1948-52), the recruitment in second felling cycle dropped down to 4063/ha. The annual recruitment was observed to have further dropped (3242/ha) in third felling cycle. In this case also the area flowered after 3 felling cycles (12 years). These facts clearly bring out that the vigour of the clumps goes down with the age (before gregarious flowering), irrespective of the site quality.

Results of the investigation discussed in this paper thus brings out that for the management of congested clumps the best alternative is to clear-fell them and then tend the clumps in such a way that they do not acquire unmanageable size. It is also brought out that a clump containing more than 60 culms creates problem in working as many unexploited culms dry and become potential fire hazards. They set in congestion and as a result the new recruitments are also deformed and broken.

SUMMARY

Clear-fellings of congested clumps of *Dendrocalamus strictus* in March 1977, (sample plot-1) and 1980 (sample plot-2) were experimented in North Shahdol Division of Madhya Pradesh. The site quality of bamboo is III. Clump formation and culm recruitments were observed in ensuing monsoon (July-September). Sample plot-1 was laid out in 1980 i.e , 4 years after clear-felling. In an adjoining area the congested clumps were clear-felled in January 1980 and sample plot was laid in December 1980. The clump formation and recruitment of culms was observed in the following monsoon. In sample plot-1 there were 44 clumps of which only 33 were fully developed for exploitation while remaining 11 were found to be in the process of development. A minimum of 5.36 new culms/clump to a maximum of 28.67 culms/clump were observed. In sample plot-2 a minimum of 3 new culms and a maximum of 29 new culms/clump were observed. However, in majority of the cases the clumps contained less than 10 culms/ clump. However, it has been clearly brought out and from these results that the best method of working of congested clumps is to clear-fell them for better results.

There was a declining trend observed in annual recruitment, as also in yield especially in period before gregarious flowering. This fact holds equally good in poor areas (Shahdol) as well as in better site quality areas (Balaghat).

संकुल बीड़ों के नि:शेष पातन का बांस (डेंड्रोकैलेमस स्ट्रिक्टस) की प्राप्ति पर प्रभाव

रामप्रसाद

सारांश

डेंड्रोकैलेमस स्ट्रिक्टस के संकुल बीडों के नि:शेष पातन के संपरीक्षण मध्य प्रदेश के उत्तरी शहडोल वनमंडल में मार्च 1977 (न्यादर्श भूक्षेत्र–1) और 1980 (न्यादर्श भूक्षेत्र–2) में किये गये। यहां के बांस तृतीय

श्रेणी के स्थान गुण वाले थे। बीड़े बनने और नये सन्धिस्तम्भ निकलने का ध्यान आगामी मानसून के समय (जुलाई-सितम्बर) रखा गया। न्यादर्श भूक्षेत्र–1 नि:शेष पातन के चार वर्ष बाद 1980 में बताया गया। इससे लगे हुये भूक्षेत्र में संकुल बीड़ों का जनवरी 1980 में नि:शेष पातन किया गया और दिसम्बर 1980 में न्यादर्श भूक्षेत्र बना दिया गया। आगे की मानसून में बीड़े की रचना और नये सन्धिस्तम्भों के आगम का पर्यवेक्षण किया गया। न्यादर्श भूक्षेत्र–1 में 44 बीड़े थे जिनमें से केवल 38 का पूर्ण विकास समुपयोजन के लिये हुआ, शेष1 1 बौड़े विकास की प्रक्रिया मे देखे गये। न्यूनतम 5.36 नये सन्धिस्तम्भ/बीड़ से लगा कर 28.67 सन्धिस्तम्भ/बीड़ तक निकले देखे गये। न्यादर्श भूक्षेत्र-2 में न्यूनतम 3 नये सन्धिस्तम्भ और अधिकतम 29 नये सन्धिस्तम्भ/बीड़ निकले पाये गए। तथापि, अधिकांश बीड़ों में 10 सन्धिस्तम्भ/बीड़ से भी कम संख्या सन्धिस्तम्भों की थी। फिर भी, यह बात भली-भांति स्पष्ट हो गई है और इन परिणामों से ज्ञात होती है कि संकुल बीड़ों में कार्य करने की सर्वोत्तम रीति ऐसे बीड़ों से श्रेष्ठनर परिणाम पाने के लिये उनका नि:शेष पातन कराना ही है।

वार्षिक नवागत सन्धिस्तम्भों में तथा प्राप्ति में भी विशेषकर सामूहिक पुष्पन होने से पूर्व की अवधि में घटते जाने की प्रवृति देखी गई। यह बात घटिया क्षेत्रों (शहडोल) के लिये भी उतनी ही सही है जितनी श्रेष्ठतर स्थल गुणों वाले क्षेत्रों (बालाघाट) के लिये सही है।

References

Anon (1970). Sample plot File No 14, South Balaghat Division of M.P. State Forest Research Institute, Jabalpur (M.P.).

Dutta, J.J. and M.S. Tomar (1964). Bamboo Forests of Madhya Pradesh. *Forest Bull.* No. 8, State Forest Research Institute, Jabalpur, M.P.

Prasad, R. (1986). Bamboo Plantation and their after care. *Forest Bull.* No. 22, State Forest Research Institute, Jabalpur, M.P.

———

LITTER FALL AND NATURAL REGENERATION OF SPRUCE AND SILVER FIR

VIRENDRA SINGH. S. BHAGAT AND S.R. ARYA

Conifers Research Centre, Shimla (Himachal Pradesh)

Introduction

In Western Himalayas, silver fir (*Abies pindrow*) and spruce (*Picea smithiana*) are important coniferous species. These species account for about half of the total coniferous growing stock in these areas. Pure stands of silver fir and spruce are rare (Troup, 1921) but these are usually associated with scattered trees of deodar (*Cedrus deodara*), blue pine (*Pinus wallichiana*), Mohru (*Quercus dilatata*), Kharsu (*Quercus semicarpifolia*) and Yew (*Taxus baccata*). Litter falls on the forest floor in the from of needles, twigs, cones, bark and small branches The amount of organic matter returned to the forest floor in the from of litter differs from species to species. This in turn affects the physical, chemical and microbiological soil properties (Dabral and Sagar, 1967). A part of the litter falling on forest floor is decomposed and remaining undecomposed litter forms a thick mat on the forest floor which causes a hinderance in the establishment of the recruits of these species (Singh and Singh, 1984). This study was undertaken to determine amount of annual litter fall on the forest floor in the mixed natural forests of silver fir and spruce.

Materials and Methods

This study was undertaken in Talghore forest of Kumarsain Range, Kotgarh Forest Division, Himachal Pradesh. This forest bears a mixed natural crop of silver fir and spruce.

Eight experimental plots of 40 m × 40 m were laid out in this forest. All standing trees in the experimental plots were enumerated specieswise. These plots had scattered trees of deodar (*Cedrus deodara*), blue pine, (*Pinus wallichiana*) and Yew (*Taxus baccata*).

Wooden trays of 50 × 50 cm were placed at a spacing of 5 × 5 m in every experimental plot towards the end of 1981. The distance of first tray from boundary line was 2.5 m. These trays were made out of wooden shooks of 1 cm thick and 7.5 cms wide. 64 trays were placed in every plot. Plastic sheet of 150 guage was nailed to provide bottom to each tray. Every experimental plot was fenced with four strands of barbed wire.

The litter study was started in the beginning of 1982 and continued till 1984. Litter was collected from the trays twice-a-year in the months of June and December. The collected litter was dried at 80°C to a constant weight. After drying, the litter was weighed. The amount of half-yearly litter was added to get the annual litter fall from every experimental plot. The litter so collected was computed for a hectare of forest floor.

Results and Discussion

Species-wise number of trees of silver fir, spruce, blue pine, deodar and yew in the different experimental plots is summarized in Table 1.

Silver fir was pre-dominant in all except in experimental plot 1 where trees of spruce were more in number. Spruce accounted for more than 50.0 per cent of total basal area of the trees in all the plots except in plot 2 and 5. Silver fir accounts for more than 50.0 per cent of the total basal area in plot 5 only. The basal area of blue pine was less than 6.0 per cent of the total basal area except in plot 1 and 2 where it accounted for 21.83 and 33.62 per cent of total basal area. The basal area of deodar or yew was not more than 5.0 per cent in any of the experimental plots (Table 2).

Tree density per ha and mean tree diameter in the experimental plots are summarized in Table 3. The maximum tree density/ha (719) was recorded in plot 5 and minimum (444) in plot 3. The mean tree-diameter at breast height varied between 28.07-33.27 cm in different experimental plots.

Table 4 shows the variation in the litter fall (g)/tray of 0.25 m^2 during different years of study. The litter fall varied from 106.8367 to 129.3250 g/tray of 0.25 m^2 in different plots during 1982. The variation during 1983 was between 105.0492 to 131.5150 g per tray. It varied from 105.5648 to 130.3375 g per tray during 1984. Table 4 shows that amount of litter fall varied slightly during different years in different experimental plots.

Table 5 summarizes the amount of litter fall per m^2 of forest floor area in different experimental plots during the present investigation. The amount of litter fall/m^2 of forest floor area varied from 427.3468 to 517.3 g in different experimental

Table 1

Species-wise number of trees in different plots

Plot No.	Number of trees of					Total
	Sf	S	B	D	Y	
1	34	40	9	1	2	86
2	30	23	17	3	1	74
3	34	30	2	2	3	71
4	56	32	3	—	9	100
5	90	14	4	—	7	115
6	47	31	3	—	1	82
7	71	23	3	—	—	97
8	78	19	2	—	3	102

Sf = Silver fir, S = Spruce, B = Blue pine, D = Deodar, Y = Yew

Table 2

Plot-wise basal area of different species

Plot No.	Basal area (cm²) of				
	Silver fir	Spruce	Blue pine	Deodar	Yew
1	15820.77 (20.58)	40144.57 (52.22)	16780.23 (21.83)	2649.85 (3.44)	1482.44 (1.93)
2	13188.05 (17.83)	32460.45 (43.90)	24860.44 (33.62)	3199.63 (4.33)	237.67 (0 32)
3	13781 74 (17.56)	59416.06 (75.70)	4161.75 (5.30)	713.78 (0.90)	421.23 (0.54)
4	21662.90 (25.12)	58570.99 (67.92)	3279.22 (3.80)	— (—)	2723.04 (3.16)
5	50198.71 (55.17)	34630.90 (38.06)	4314.77 (4.74)	— (—)	1847.54 (2.03)
6	32832 61 (35.65)	54981.79 (59.70)	4160.99 (4.52)	— (—)	122.66 (0.13)
7	38198 03 (44.62)	44805.34 (52.33)	2609.32 (3.05)	— (—)	— (—)
8	40342.65 (46.42)	44320.73 (50.99)	1643.11 (1.89)	— (—)	610 31 (0.70)

Figures in the brackets are percentage of basal area of the species of the total basal area in a plot.

Table 3

Tree density per ha and mean tree diameter at dbh in different plots

Plot No.	Tree density/ha	Mean D.B.H. (cm)
1	538	31.22
2	463	31.46
3	444	33.27
4	625	28.45
5	719	28.07
6	513	33.52
7	606	30.29
8	638	29.21

plots during 1982. In 1983, it varied from 420.1968 to 526.06 g/m² of forest floor area. During 1984, it varied from 422.2592 to 521.35 g/m² of forest floor area.

Litter fall kg/ha/yr in different experimental plots is summarized in Table 6. The maximum litter fall kg/ha/yr during 1982, 1983 and 1984 was recorded in experimental plot 5, 1 and 6 respectively.

The result of comparison of basal area and litter fall has showed that the litter fall (g) per cm² of basal area decreased as the basal area increased (Table 7). The

Table 4

Litter fall (g) collected per tray of 0.25 m²

Plot No.	Litter fall (g) 0.25 m²		
	1982	1983	1984
1	126.5043	131.5150	125.5257
	±13.8172	±17.7148	±23.3585
2	123 0531	119.0904	118.0245
	±19.3818	±15.8611	±29.3740
3	113.8421	110.8284	108.5523
	±17.4858	±17.4353	±24.8931
4	113.5890	111.1125	113.7745
	±12.7154	±19.6988	±14.0397
5	129.3250	128.5500	126.6632
	±16 4766	±17.9682	±26.6186
6	124.8507	128.2868	130.3375
	±12.9410	±18 6832	±26.5299
7	106.8367	105.0492	105.5648
	±18.2660	±18.0219	±19.6084
8	108.4695	112.2234	110.6333
	±19.4830	±21.0262	±22.1825

Table 5

Litter fall (g) per m² of forest floor area

(During 1982 to 1894)

Plot No.	1982	1983	1984
1	506.0172	526 0600	502.1028
2	492.2124	476 3616	472.0980
3	455.3684	443.3136	434 2092
4	454.3560	444.4500	455 0980
5	517.3000	514 2000	506 6528
6	499.4028	513.1472	521 3500
7	427.3468	420 1968	422 2592
8	433.8780	448.8936	442.5332

Table 6

Litter fall kg/ha/yr in different plots

Plot No.	Litter fall (kg/ha) on the forest floor area		
	1982	1983	1984
1	5060.1720	5260 6000	5021.0280
2	4922.1240	4763.6160	4720.9800
3	4553 5840	4433. 360	4342.0920
4	4543 5600	4444 5000	4550.9800
5	5173.0000	142.0000	5066.5280
6	4995.0280	5131.4720	5213.5000
7	4273.4680	4201.9680	4222.5920
8	4338.1780	4488.9360	4425.3320

Table 7

Litter fall (g)/cm² (basal area) in the experimental area

Basal area classes (000 cm²)	Litter fall (g)/cm² of basal area			Mean
	1982	1983	1984	
70–<85	63.04	63.04	61.42	62.62 ±1.05
85–<100	55.53	56.11	56.15	55.93 ±0.35

Table 8

Tree density/ha and litter fall/tree (kg)

Tree density classes	Mean litter fall/tree (kg)			Mean
	1982	1983	1984	
400–< 500	10.44	10.13	9.99	10.19
500–< 600	9.56	9.88	9.73	9.72
600–< 700	7.03	7.02	7.06	7.04
700 & above	7.19	7.15	7.04	7.13

relationship between tree density per ha and litter fall per tree (kg) indicated that tree density significantly affected the litter production per tree. The litter produced per tree was more in the plots which had lower density of trees and vice versa. The litter produced per tree in tree density classes of 400–<500 and 500–<600 was significantly different at 1% level. However, litter produced per tree in tree density classes of 600–<700 and 700 and above did not differ significantly at 1.0% and 5.0% level respectively (Table 8).

This study reveals that forests of silver fir and spruce receive a large quantity of litter annually According to Dhillon (1961) the rate of litter decomposition is slow owing to tough nature of the material and prevailing cold climate in these forests and results in accumulation of litter on the forest floor. This litter forms a thick mat on the ground. Singh and Singh (1984) reported that radicals of silver fir and spruce seedlings, are unable to strike the mineral soil because of the matting of undecomposed litter on the forest floor, dried as a result of high insolation in these forests.

Jha *et al.* (1984) reported that hydrophobic substances are released on the decomposition of fir and spruce litter which restrict the wetting of soil. Thus acute moisture stress causes mortality of seedlings of silver fir and spruce in these areas Dhillon (1957) also reported that accumulation of raw humus (litter) affects the natural regeneration of conifers.

SUMMARY

The litter fall in the mixed forest of silver fir and spruce was studied for a period of three years. The maximum annual litter fall varied from 5260.6 to 5173.0 kg/ha/yr in different experimental plots. The litter accummulation has adverse effect on natural regeneration of silver fir and spruce.

प्रसरल और रजत तालीसपत्र में पर्णपतन और प्राकृतिक पुनर्जनन

वीरेन्द्र सिंह, एस० भगत व एस०आर० आर्य

सारांश

रजत तालीसपत्र और प्रसरल के मिश्र वन में पत्ते गिरने का अध्ययन तीन वर्ष तक किया गया। अधिकतम वार्षिक पर्णपतन 5260.6 से 5173.0 किग्रा/हैक्टे/वर्ष विभिन्न संपरीक्षण भूखण्डों में होता पाया गया। पर्णास्तरण के जमा होने का रजत तालीसपत्र और प्रसरल के प्राकृतिक पुनर्जनन पर कुप्रभाव पड़ता है।

References

Dabral, B.G. and Vidya Sagar (1967). Litter studies in the forest plantation at New Forest. *Proc. Eleventh Silvicultural Conference*. Vol. II. 365-471. F.R.I., D. Dun.

Dhillon, G.S. (1957). Natural regeneration of conifers. *Proc. Ninth Silvicultural Conference*. Part I., 161-168, F R.I., D. Dun.

.... (1961). Recent trends in natural regeneration techniques for silver fir and spruce forests. *Proc. Tenth Silvicultural Conference*. Vol. I., 313–321., F.R.I., D. Dun.

Jha, M.N., R.K. Rathore and P. Pande (1984). Soil factor affecting the natural regeneration of silver fir and spruce in Himachal Pradesh. *Indian For.*, **110** (3) : 293-298.

Singh, Virendra and R.V. Singh (1984). Seed dispersal, seed germination and seedling establishment in natural forests of silver fir and spruce-II. Seed germination and seedling establishment. *Indian For.*, **110** (7) : 632-639.

SUNDARBANS MANGROVES—BIOMASS PRODUCTIVITY AND RESOURCE UTILIZATION AN INDEPTH STUDY

KALYAN CHAKRABARTI
Deputy Director,
Forests and Wildlife, Calcutta (West Bengal)

Introduction

Sundarbans mangroves provide the basic necessities of life to the mangrove dwellers in their risk-ridden professions in one of the densest vegetation cover in the world. Conservation of mangrove resources is the Keyword of development of the region. Silviculture and ecology should form the basic tenets of conservation policy of the Sundarbans mangroves.

Material and Methods

The author during a period of fifteen years in his forestry profession in capacities of Field Director, Sundarbans Tiger Reserve and other Official assignments had, on innumerable occasions, visited the mangrove forests of Sundarbans and studied various aspects of silviculture, ecology, forest formations and utilization of mangrove species apart from floral and faunal diversity of the estuarine tract. Innumerable beneficiaries of the mangrove habitat like honey collectors, fisherman and wood cutters and sight seers and other persons directly or indirectly connected with the mangrove would were interviewed and replies to several questionnaires were recorded which were analysed statistically to arrive at reasonable conclusions. Informations on tanning materials of mangrove barks were collected, tested and monitored. Relevant information were also collected on pulping qualities of mangrove species after necessary field trials and tests. Informations on approximately ten year old mangrove species were collected from the working and felling coupes and statistics on total dry weight of all mangrove species in stem, roots and branches, twigs and leaves were collected in one hundred m^2 sample plots. The weight was taken after 48 hours of sun drying.

Result and Discussions

(a) *Utilization of mangroves* : The mangroves contain an appreciable percentage of tannins in their barks. Mangrove tans are included in the category of catechol tans. A very significant supply of tan barks in the international market comes from Borneo, Phillipines and East Africa. The analysis of mangrove tans with other important tan stuff is given in Table 1.

Table 1

Table showing mangrove tan stuff alongwith others

Tan stuff	Percentage of tan	Red colouring matter
Wattle Indian origin	22	—
Wattle African origin	39	60
Oak-European	12	60
Myrabolan	41	28
Mangrove	38	60

For commercial exploitation, the species with less than 30% tannin is not an economical proposition. In the Sundarbans quite a good number of mangrove species contain a good amount of tann in their bark. The tannin contain of important species is given below.

Species	Tan	Soluble Non-tans	Insolubles	Moisture
Passur (*Carpa molucoensis*)	23.70	08.37	67.84	0.09
Dhundal (*C obovata*)	31.80	10.62	56.65	0.03
Kankra (*Brugiera gymborihiza*)	35.29	11.95	42.26	10.50
Garjan (*Rhizophora mucronata*)	35.00	14.00	50.91	0.09
Math Goran (*Ceriops canclolleana*)	38.00	5.80	43.00	13.20
Goran (*Ceriops roxburghiana*)	20.24	13.40	66.30	0.06

Goran forms about 30% of all floral species in the Sundarbans. It has a catechol tannin with a little percentage of Pyro-gallol. Goran is reported to produce an ugly red colour in the leather. Tanning process requires so many varied conditions of pH, astringency and non-tans that a mixture of tannins are used for any suitable mixture.

Mangrove barks have, following disadvantages for use as commercial tans; (a) Colour (b) Astringency (c) Lack of Sugary matter (d) Hardening of leather. However, with use of mixtures, chemicals and extracts with other tan basis the dis-advantages may be largely removed. It is unfortunate that no commercial utilisation of mangrove bark has yet been made. There are certain practical limitations. Mangrove bark of Sundarbans loose much of tan value on their prolonged felling, logging, and transport from the forests to the nearest commercial centre and the tan value at the commercial centre is reduced to even 15%. Mangrove tan has, however, the reputation of rapid penetration and giving good weight of leather but these practical bottlenecks are to be solved before they are actually put to use on any commercial scale. It was held by experts that a suitable tannin extract can be prepared by blending the Goran bark with myrabolan in the ratio 3 : 1. This concentrated extract when subjected to spray drying, produces a powder containing about 60% tannin. These tannins are used in leather, ink, plastic and formaldehyde industries.

The pulping qualities of mangrove species have also been proved to be quite useful as the autoclave tests on Keora (*Sonneretia apetala*) Genwa (*Excaecaria agallocha*) and Baen (*Avicennia officinalis*) indicate.

	Pulp yield percentage	Chlorine number	Bleach con-sumption percentage
Keora	48.44	6 79	6.66
Genwa	44.14	6.76	7.85
Baen	34.69	5.84	6.00

Apart from these uses, excellent quality of charcoal is produced from Rhizophora (Garjan) which has a very heavy demand. Firewood is produced from many mangrove species and is heavily exploited. Heritiera (Sundri) is the most valuable

timber of mangrove forest. Excaecaria has also the potentiality of raw material for match wood apart from pulpwood. Various parts of mangrove plants could be used for human consumption. The fruits of Avicennia (Baen) and Sonneretia (Keora) are edible. as are the seedlings of Avicennia. Radicles of Brugiera (Kankra) are also fit for human consumption. Salads are made from the leaves of Sonneretia (Keora) and form the herb Sisuvium (Gimasag). Nipa fruticans (Golpatta) is a very useful plant of the mangroves. Lower surface of young leaves may be used as cigarette wrappers, while the older leaves are used for thatching purposes. The leaves also serve as raw–material for the paper industry. The sap of the inflorescence can be tapped for sugar, alcohol, vinegar production while it's tapping given a juice and it can be used for production of liquor. The mangroves support and sustain marine fisheries by serving as nurseries and as feeding ground for many marine invertebrates and fish and by producing large amoumt of detritus for the marine food cycle. These forests serve as a link between terrestrial and marine ecosystem which is highly productive. These also provide substratum for bacteria and fungi. This process of partial digestion and microbial growth is repeated and constitutes the basis for the detritus food web. Innumerable species of crustaceans, molluscs and fish take part in the degradation of dead plant tissues. Many species of shrimps spawn off-shore using mangrove as a reuge and feeding ground in later stages of life cycle. Mud crab, *Scylla serrata* forms a highly delectable item of food. Mangrove oysters are highly marketable edibles.

In the Sundarbans there are about 90 species of fish, a good number of which form commercial species. Myriads of species and individuals of invertebrates their specialised life cycle, colouration and behaviours pattern in coastal and sandy shore are specific qualities of the mangroves, of the mammals the occurrence of tigers and their mysterious behaviours pattern are legendary examples of Sundarbans. Pigs and spotted deer are also abound. Estuarine crocodiles are the largest and most ferocious of all crocodiles. Monitor lizards, rhesus monkeys, fishing cats, dolphins and sharks in water are few among many animals of the mangroves. Rhesus monkeys also occur in Sundarbans mangroves. In marginal forest lands of Sundarbans a large number of local migratory birds aggregate in breeding season which include cormorants, darters, herons, egrets, whimbrels and many other marsh and water birds But above all these mangrove forests act as a buffer to counteract the mighty force of cyclonic wind and waves of the sea.

(b) *Biomass productivity of mangrove forest formations*: The biomass productivity of ten forest formations was calculated in one hundred square metre sample plots apportioned into stems, roots, branches, twigs and leaves on the basis of weightage of green matters. Then the whole mass was dried for 48 hours to get the dry biomass productivity per hectare. The whole data is exhibited in Table 2. The dry weight was taken after air-drying for 48 hours which gave a moisture loss between 5 to 25 per cent depending on formations.

It would appear from the tables shown that total biomass per hectare varies from 9.5 metric tonnes to 212 3 metric tonnes and Avicennia-Sonneretia records the

Table 2

Table showing biamass productivity of Sundarbans mangroves

Habitat formation	Number of stems per hundred m²	Average dry weight in kgs.				Total biomass in metric tonne per ha
		Stem	Root	Branch, twigs and leaves	Total	
Heritiera–Phoenix	125	700 (46%)	325 (21%)	475 (33%)	1500	150
Heritiera–Excaecaria	110	1100 (53%)	425 (21%)	525 (26%)	2050	205
Heritiera-Excaecaria-Cereops	122	962 (52%)	372 (21%)	598 (27%)	1832	183.2
Pure-Cereops	15	137 (51%)	49 (22%)	42 (27%)	228	22.8
Avicennia–Cryza	7	58 (61%)	20 (21%)	17 (18%)	95	9 5
Avicennia–Sonneretia	75	1400 (65%)	480 (22%)	343 (13%)	2123	212.3
Rhizophora–Brugiera	30	423 (46%)	256 (27%)	313 (27%)	911	91.1
Excaecaria–Cereops	95	797 (56%)	294 (21%)	329 (23%)	1415	141 5
Excaecaria–Phoenix	61	427 (51%)	116 (14%)	287 (35%)	825	82.5
Pure–Excaecaria	30	368 (51%)	131 (22%)	128 (27%)	627	62.7

maximum total and stem-wise biomass productivity per hectare. Heritiera-Excaecaria records second in total maximum biomass productivity. *Rhizophora-Brugiera* forest formation records however the maximum biomass productivity per hectare for roots (27% of total biomass) and for branch, leaves and twigs (27% of total biomass productivity). These relevant information may now be compared with other similar information of mangrove forest formation in other mangrove area of the world for comparison. Keora wood was found to be the best giving the highest pulp yield out of the mangrove species. This indicates that there is a good potentiality of commercial utilisation of mangrove species on pulp. In these days of acute pulp shortages, such attempts are worth taken.

(c) *Management of mangroves* : The management of mangroves needs intensive care and intimate knowledge of organisms-both flora and fauna. From the botanical

point of view mangrove plants have some special features. The Chief of them are the high osmotic pressure developed by the cell sap which help them to draw water from the concentrated soil solution, the pneumatophores, the vivipary, the special stomata and salt glands on the leaves. The crystals which are often found deposited on the surface of the leaves vary in their chemical nature from plant to plant. Micro-flora and micro-fauna also reveal interesting special feature in this unique ecosystem.

Man -- mangrove interaction has been very revealing in this ecosystem and men had, since time immemorial, been using mangroves for their economic sustenance to eke out a living and in the process modifying the environment as well. As such the mangrove management in Sundarbans has to take into account all these biotic and abiotic factors to evolve a time honoured but ecologically sustainable system.

The total forest area under mangrove vegetation in Sundarbans is about 4262 square kilometres which is presently under the administrative control of two forest divisions – Field Director, Sundarbans Tiger Reserve under whose jurisdiction an area of 2585 square kilometres of Project Tiger area is located, the balance area of 1677 km^2 is under the control of Divisional Forest Officer, 24 Parganas Division. In the Project Tiger area, an area of 1330.10 km^2 is included within the core area where all forestry operations is prohibited. In addition to this there is another area of 362.40 square kilometres constituting Sajnakhali wildlife sanctuary. Silvicultural system adopted for forest exploitation in the entire mangrove area of Sundarbans is selection-cum-improvement felling. Within the jurisdiction of 24-Parganas Division, the following wildlife sanctuaries are managed :

		Area (km^2)
(1)	Haliday Island	3.50
(2)	Lothian Island	38.00

A scheme of breeding and farming of crocodiles, (*Crocodilus porosus*) is also under implementation at Bhagabathpur under the jurisdiction of Divisional Forest Officer, 24-Parganas Division. About fifty per cent of total mangrove areas of Sunderbans is water—Sunderbans mangroves contain enormous blanks which may be categorised into the following types :

(a) Blanks devoid of any vegetation.

(b) Blanks under scrubby growth of *Ceriops roxburghiana*.

(c) Blanks under scrubby growth of *Phoenix paludosa*.

(d) Other saline blanks having poor, stunted growth of *Excaecaria agallocha* and other mangrove species.

There is a vast potential to increase the total biomass productivity of the region through balanced and complementary land uses through improved forestry practices and through intensive silvicultural research and management. It is unfortunate that the problem areas narrated above constitute about 15% of total mangrove area of Sundarbans which practically does not contribute to biomass productivity of the region. The challenge of silviculture today is treat these problem areas and to convert the same to productive assets.

Mangrove swamps of Sundarbans are perhaps one of the most ideal area for conducting bio-ecological research.

SUMMARY

Sundarbans mangroves represent a dynamic wetland ecosystem having vast potentiality in biological resources. The paper describes the diversity of floral and faunal resources alongwith its utilisation potential. It also stresses the need of optimum and balanced form of mangrove habitat uses for the cause of human welfare. The paper also gives an outline for potentiality of forest based industries with mangrove raw materials. The paper also gives a quantitative assessment of biomass productivity of mangrove forest formations. It was estimated to be 212 M.T./ha, the highest, in Avicennia-Sonneretia forest formation. The distribution of biomass among stem, root and branches, under verious forest formation has also been discussed. Conservation of mangrove resources is the keywood of development of the region. Silviculture and ecology should form the basic tenets of conservation policy of the Sundarbans mangroves.

सुन्दरवन के वायुशिफ—जैवपुंज उत्पादकता संसाधनों का उपयोजन —एक गहराई से किया गया अध्ययन

कल्याण चक्रबर्ती

सारांश

सुन्दरवन के वायुशिफ एक गतिमान आर्द्रभूमि परिस्थिति_सहति हैं जिसमें जैविकीय संसाधन निर्माण करने की बहुत सभावनाए हैं। इस अभिपत्र में उसके पेड़-पौधों तथा पशु-पक्षियों की विविधता और उनकी उपयोजना संभावनाएं बताई गई हैं। इसमें वायुशिफ प्राकृतावास साधनों को मानव कल्याण के लिये इष्टतम और संतुलित रूप से काम लगाने पर भी बल दिया गया है। अभिपत्र में यहां से मिलने वाले कच्चे माल को लेकर वनाधारित उद्योग खड़े करने की सभावनाओं की रूपरेखा भी दी गई है। वायुशिफ बनों की जैवपुंज उत्पादकता का परिमाणात्मक आकलन भी दिया गया है। अनुमान लगाया गया है कि एवीसीनिया-सोनरेशिया वनों में यह अधिकतम 212 मी० टन/हिक्टेयर के लगभग होगा। तने, जड़ और शाखाओं में इस जैवपुंज का वितरण भी विभिन्न प्रकार के वनों में कैसा होगा यह भी विवेचित किया गया है। वायुशिफ-संसाधनों का संरक्षण इस क्षेत्र का विकास करने में महत्वपूर्ण बात है। सुन्दरवन के वायुशिफों की संरक्षण नीति तैयार करने में वनसवर्धन और परिस्थिति विज्ञान को आधारभूत सिद्धान्त बनाया जाना चाहिये।

References

Aush, A. (1935). Journal of American Leather Chemists Association.

Chakrabarti, Kalyan and A.B. Chaudhury (1974). Biological study of Fish and Fish resources and biolog cal basis of a rational fishery, *Sci. and Culture*, Vol 40.

................(1972). Wildlife Biology of Sundarbans Forests, Honey production and behaviour pattern of a honey bee, *Sci and Culture*, Vol. 38.

................(1974). A Scientific note as to how human casualties due to man-eating tigers can be reduced, *Sci. and Culture*, Vol. 40.

Chakrabarti, Kalyan (1984). An Eco-biometrical study on Tiger in the estuarine ecosystem of Sundarbans, *Indian For.*, **110**. (6) : 540-551.

Das, B.M. (1924). *Indian Forest leaflet* 73, 74 & 75.

Pilgrim, J. A. (1920). *Tan stuff of Sundarbans Development, Department of Industry, Bengal— Bulletin 2.*

Phillips, F.H. and A.J. Watson (1959). *Division of Forest Product Tecnological Paper No. 8 CSIRO, Australia.*

Wise, L.E., M. Murphy and A.A. D'addieco (1946). Composition of tropical woods, First Technical Report to the *Department of Navy Office and Naval Research, Appleton, Wisconsin.*

Wilson, T.A. (1924). Mangrove Tanning—*Sci. & Industry* Vol. II.

STUDIES ON VARIABILITY AND ASSOCIATION OF YIELD AND ITS COMPONENTS IN *SOLANUM ELAEAGNIFOLIUM* CAV.

K.R. KHANNA AND S.P SINGH

National Botanical Research Institute, Lucknow (U.P.)

Introduction

Solanum elaeagnifolium Cav. is one of the solasodine yielding crops and has the potential to produce solasodine on a commercial scale. The solasodine content has been reported to be 3.2% (Maiti and Mathew, 1967) in dry berries and the plant is completely spineless. There has been no work on agro-technology or breeding of this plant. The present findings should help in its genetic improvement.

Material and Methods

The material for the present investigation comprised 47 plant genotypes selected from a large plant population grown at National Botanical Research Institute, Lucknow. The seeds were sown in earthen pot and 50 days old seedlings were transplanted in the second week of September. The crop was harvested in the last week of May to early June of the following year. The row to row and plant to plant distance were 0.45 m × 0.30 m, respectively. The observations were recorded on individual plants for plant height (cm), number of branches/plant, number of berries/bunch, number of seeds/berry, test weight (25 berries), moisture content (%), number of berries/plant, solasodine content (%), and berry yield/plant (g). The solasodine content was estimated as described by Khanna and Murty (1972).

Coefficient of variability and correlation was calculated following Panse and Sukhatme (1961). The path coefficient was estimated according to Dewey and Lu (1959).

Results and Discussion

The extent of variability present among various characters is presented in Table 1. Data indicated sufficient variation for different characters. The maximum range of variation (52-290) was exhibited by no. of berries/plant with mean of 126.44 ± 8.44 followed by yield/plant (17.01-150.50 g) and no. of seeds/berry (13.40-77.60) with mean values of 63.52 ± 4.30, and 48.56 ± 2.02 respectively Solasodine content ranged from 0.64 to 3.90 per cent with mean of 1.75 ± 0.14. Coefficient of variability is a relative measure of variability. Its highest value was observed for solasodine content (55.58%) followed by yield/plant (46.42%) and no. of berries/plant (45.76%). The test weight and number of seeds/berry showed c.v. of similar magnitude (28.02% and 28.63%). The high coefficient of variability indicates that these characters should respond well to selection.

In case of complex traits, selections based on the character itself are usually less effective than these based on its components. Thus the correlation studies amongst the

Table 1

Variability for different characters in Solanum elaeagnifolium

	Plant height	No. of branches/ plant	No. of berries/ bunch	No. of seeds/ berry	Test weight of 25 berries	No. of berries/ plant	Moisture content (%)	Berries yield/ plant	Total glyco-alkaloid content
Mean	48.489 ±0.145	7.297 ±0.346	5.959 ±0.189	48.560 ±2.028	18.410 ±0.752	126.446 ±8.440	66.519 ±0.106	63.521 ±4.302	1.754 ±0.142
Range	38.00–82.00	3.00–12.00	3.67–9 34	13.40–77 60	8.00–28 00	52 00–290.00	54.29–78.00	17.01–150 00	0.64–3.90
C.V.	19.031	32.561	21.765	28.638	28.022	45.764	10.612	46.428	55 580

Table 2

Correlation coefficients among yield and its component traits in Solanum elaeagnifolium

Character association	No. of branches/ plant	No. of berries/ bunch	No of seeds/ berry	Test weight	Moisture content	No. of berries/ plant	Alkaloid content	Berries plant
Plant height	0.145	–0.159	0.098	0.306*	0.220	–0.106	–0.438**	0.188
No. of branches/plant	X	0.230	0.318*	0.151	0.020	0.594**	0.039	0 515**
No. of berries/bunch		X	0.317*	0.145	–0.019	0.219	–0.013	0 231
No. of seeds/berry			X	0.457**	0.068	–0.019	–0.014	0.301*
Test weight				X	0.196	0.037	0.040	0.481**
Moisture content					X	0.035	–0.145	0.197
No. of berries/plant						X	–0.135	0.782**
Alkaloid content							X	–0.154

* Significant at 0.05; ** Significant at 0.01

Table 3

Path coefficient analysis for berries yield in Solanum elaeagnifolium

*(The values on the main diagonal (Marked *) show direct effects)*

Character	Plant height	No. of branches/ plant	No. of berries/ plant	No. of seeds/ berry	Test wt. (25 berries)	No. of berries/ plant	Correlation
Plant height	0.1820*	-0.0211	0.0016	0.0197	0.0991	0.0935	0.188
No. of branches/plant	0.0264	-0.1460*	-0.0024	0.0641	0.0489	0.5240	0.515
No. of berries/plant	-0.0289	-0.0335	-0.0105*	0.0639	0.0469	0.1932	0.231
No. of seeds/berries	0.0178	-0.0464	-0.0033	0.2015*	0.1481	-0.0167	0 301
Test weight	0.0557	0.0220	-0.0015	0.0921	0.3240*	0 0326	0.481
No. of berries/plant	-0.0193	-0.0867	-0.0023	-0.0038	0 1190	0.8822*	0.782

Residual effect : 0.3701

characters of interest are essential. Correlation coefficients between the yield and its components are presented in Table 2. Out of 36 combinations, 26 were positive and 10 were negative. Berries yield/plant was positively associated with all the characters except solasodine content which had negative correlation with yield (–0.154). The significant positive correlation of yield, however, was observed only with no. of berries/plant, no. of branches/plant, test weight and number of seeds/berry. Among yield components, the number of berries/plant had positive correlation with no. of branches/plant, number of fruits/bunch, test weight and moisture content but significant association was noticed only with number of branches/plant.

The path analysis approach was followed to partition correlations into direct and indirect effect to know the relative importance of component traits towards yield. This is presented in Table 3. The number of berries/plant showed the highest direct path towards yield (0.882). It had negative indirect effect *via* all the characters except test weight. In contrast, the number of branches/plant which had next the highest correlation with yield, showed negative direct path effect but had positive indirect effect *via* plant height (0.0264), number of seeds/berry (0.0641), test weight (0.0489) and no. of berries/plant (0 5240). The positive indirect effect *via* above traits counterbalanced the negative direct path towards the yield. The path analysis, thus, contrary to the correlation results, shows that this character need not be selected for yield improvement. The number of berries/bunch also had negative direct effect (0.01105) but was indirectly affected *via* number of berries/plant (0.0469). The test weight (0.3240) and the number of seeds/berry (0.2015) exhibited positive direct path towards yield. They were also indirectly affected *via* each other and plant height.

The residual effect of 0 3701 indicated that there may be some important characters that could not be utilized in the present material.

SUMMARY

Variability, correlations and path coefficient analyses were studied, for yield, its component traits and solasodine content in *Solanum elaeagnifolium* Cav. The maximum range of variation was observed for the number of berries/plant followed by the berry yield/plant. Solasodine content ranged from 0.04 to 3.90 per cent with mean of 1.75 ± 0.14. Coefficient of variability was high for the solasodine content followed by the berry yield/plant, the number of berries/plant and the number of branches/plant. Berry yield/plant was positively and significantly correlated with number of berries/plant, number of branches/plant, test weight and number of seeds/berry. Solasodine content had negative association with all the characters. Number of berries/plant showed the highest direct path towards yield followed by test weight and number of seeds/berry. Number of branches/plant though had negative direct effect but indirectly affected yield *via* number of berries/plant, test weight, number of seeds/berry and plant height.

सोलेनम इलिएग्निफोलियम कैव० की प्राप्ति और इसके संयोगांगों की विभिन्नता और साहचर्य संबन्धी अध्ययन

के०आर० खन्ना व एस०पी० सिंह

सारांश

सोलेनम इलिएग्निफोलियम कैव० प्राप्ति में विभिन्नता, सहसंबन्ध तथा पथ गुणांकों के विश्लेषण, इसके संयोगांग के लक्षण और सोलेसोडीन तत्व का अध्ययन किया गया। बदरी/पादप संख्या की अधिकतम विभिन्नता सीमाओं का परिवेक्षण किया गया, और उसके बाद बदरियों की प्राप्ति/पादप का। सोलेसोडीन तत्व की सीमाएं 0.01 से 3.90 प्रतिशत तक निकली जिनका औसत 1.75 ± 0.14 रहा। सोलेसोडीन तत्व का विभिन्नता गुणांक अधिक पाया गया, उसके पश्चात् क्रमश: बदरियों की प्राप्ति/पादप, बदरियों की संख्या/पादप और शाखाओं की सख्या/पादप के विभिन्नता गुणांक रहे। बदरियों की प्राप्ति/पादप का सहसंबन्ध बदरियों की संख्या/पादप शाखाओं की संख्या/पादप, परीक्षित भार, बीजों की संख्या/बदरी के साथ घनात्मक और सार्थक पाया गया, सोलेसोडीन तत्व का सहसंबन्ध इन सभी लक्षणों के साहचर्य में ऋणात्मक पाया गया। बदरियों की सख्या/पादप का प्राप्ति पर जाता सर्वाधिक सीधा मार्ग देखा गया जिसके बाद परीक्षित भार और बीजों की सख्या/बदरी रहा। शाखाओं की संख्या/पादप का सहसंबन्ध यद्यपि ऋणात्मक सीधे प्रभाव वाला पाया गया परन्तु बदरियों की संख्या/पादप, परीक्षित भार, बीजों की संख्या/बदरी और पादप की ऊंचाई के द्वारा परोक्ष रीति से प्राप्ति पर भी उसका प्रभाव पड़ा।

References

Dewey, D.R. and K.H. Lu (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.*, **51** : 515-518.

Khanna, K.R and A.S Murty (1972). Effect of fruit stage and maturity on the glyco-alkaloid content in *Solanum khasianum*. *Planta Med.* **21** : 182-187.

Maiti, P.C. and R. Mathew (1967). Rich source of solasodine. *Curr. Sci.*, **36** : 126.

Panse, V.G. and P.V. Sukhatme (1961). *Statistical Method for Agricultural Workers.* ICAR, New Delhi.

ETHNOBOTANICAL STUDIES ON SOME PLANTS OF BURNIHAT VALLEY, ASSAM / MEGHALAYA

SAS BISWAS* AND A. AHMED

Systematic Forest Botany Branch,
State Forest Service College-cum-Research Centre, Burnihat (Assam)

Introduction

Though the present century is the day of synthetic pills and other modern products, the primitive knowledge on plants occurring in wild, is highly acknowledged by the global population. This is because of the dependence of forest dwelling population on natural plant products directly for food and drugs. It has been observed that many of the plants utilized by the tribals for various purposes do not bear correct identity with specific reference to their scientific names. It is believed that after systematic scientific scrutiny, the data gathered here may provide interesting materials in the search for a safe potent medicine and substitute for vegetables used as food traditionally.

The population of the area where the investigation was undertaken consists mostly of tribals, viz, Mikirs, Garos, Kacharis, Khasis and Nepalese (settler). Out of the forementioned tribes Garos and Kacharis is fall in Bodo groups and they are of Indo-Mongoloid origin, whereas the Mikirs are Mongoloid Assamese. The Khasis are Australoid in origin and believed to be more primitive than Mongoloids.

Topography and Climate

The present studies were carried out in ca 160 sq. km area of Burnihat Valley covering a territory of the States of Assam and Meghalaya. The Valley is situated ca 24 km south of Guwahati (Assam) and ca 85 km north of Shillong (Meghalaya). The area lies between NS 91° 9′ and 92° to 25° 3′ and 26° 1′ EW. The configuration is hilly and its elevation ranges from 200 to 400 m above the sea level.

The valley is drained by two main rivers, viz—Digaru (Umtru) and Kiling, the former flows northwards and the latter southwards. The climate is hot and humid with dry cold season. The average annual rainfall ranges between 250 to 300 cm. The maximum temperature recorded for the area is 35°C (in April/May) and minimum 8.9°C (in January).

Method

The chief of the aborgines and some competent tribesmen (Ojha/Kabiraj) were approached and consulted for their knowledge regarding the use of various plant species occurring in their area. The information furnished by them were recorded together

---

* Presently at Systematic Botany Branch, F.R.I, and Colleges, Dehra Dun.

with the collection of herbarium specimens used by the tribals for food and medicine, for correct identification from the area studied. They have been maintaining this practice from generation to generation with the prescription from the medicinemen (Ojha). The utility of various plants and their parts is an important part of tribals folklore as given below :

1. *Adhatoda vasica* Nees.

Shrub with white flowers.

Distribution : Throughout the plains of the country and upto 1500 m in the Sub-Himalayan tracts; Burma, Sri Lanka, Malaya Peninsula and Archipelago.

Uses : The leaves are eaten by Mikirs as vegetable.

2. *Amorphophallus bulbifer* Bl.

Tuberous herb, leaves 3-partite. Spadix little longer than the spathe.

Distribution : North-Eastern Region.

Uses : Petiole and peduncle are boiled and eaten with salt and chillies by the tribals.

3. *Boerhavia diffusa* L.

A perennial herb with pinkish flowers.

Distribution : Throughout India.

Uses : Leaves are used as vegetables by Mikirs. Leaves juice is applied by them in opthalmic disease and stomach disorders.

4. *Bridelia retusa* Spreng

Tree with elliptic lanceolate leaves; flowers greenish-yellow; fruit drupe-globose.

Distribution : Throughout India and Burma.

Uses : The leaves are used by Mikirs for smoking purposes.

5. *Cellicarpa arborea* Roxb.

Small tree with elliptic-lanceolate leaves; flowers purpose.

Distribution : Found in Sub-Himalayan tracts from Kumaon to Bengal; common in North-Eastern region.

Uses : Flowers are eaten by Mikirs as vegetables.

6. *Ceratopteris thalictroides* (Linn.) Broungn.

Fern with circinnate and green apical shoots; Sterile lamina; Unipinnate.

Distribution : North-Eastern region, U P., Bihar, West Bengal, Orissa, Tamil Nadu, Kerala.

Uses : Leaves used as green vegetables. The shoots are chopped, washed and fried in mustard oil.

7. *Chromolaena odorata* (Linn.) King and Robinson.
Straggling shrub with light blue fragrant flowers.

Distribution : Native of West Indies and America and probably introduced from Jamaica to India and Burma.

Uses : The crushed tender leaves when applied externally it stops bleeding caused by ordinary cuts and relief pain.

8. *Clerodendrum viscosum* Vent.
Shrub with a large terminal panicle.

Distribution : Throughout India upto 905 m and Malaya Peninsula.

Uses : The juice of the tender leaves is taken after sligtly warming against dysentry and diarrhoea.

9. *Cnesmone javanicum* Bl.
Evergreen twining shurb with ovate-oblong leaves.

Distribution : Assam, Meghalaya, Bangladesh and Burma.

Uses : Bruised roots are applied externally for headache, also used in larval attack of cattle.

10. *Colocasia esculenta* (L) Schott.
A perennial tuberous plant with a group of underground farinaceous corns.

Distribution : Native of South-East Asia.

Uses : The wild variety of above mentioned species is eaten during the times of famine.

11. *Commelina benghalensis* L.
Succulent herb with starchy and mucilaginous rhizome.

Distribution : Throughout India (Moist region).

Uses : The leaves are eaten as vegetables by Mikirs.

12. *Costus speciosus* (Keening) sm.
Erect plant with tuberous rhizome and red bracts.

Distribution : Thoughout India upto 1500 m, common in Bengal.

Uses : The juice of crushed rhizome is taken by women during pre-natal-labour to check nausea, delirium and vomitting tendency. This is applied externally on scalp to relief the same. The stem is taken as vegetables by Garos.

13. *Datura metel* L.

Shrub with triangular ovate-leaves; flowers often double or triple, reddish or purple.

Distribution : Native of South America. Occurs throughout India and South Europe.

Uses : Ash obtained from roasted fruit is mixed with coconut oil and applied externally to cure abscesses. The leaves are crushed and applied externally for headache, giddiness and delirium.

14. *Dendrocalamous hamiltonii* Nees & Arn.

Large tufted bamboo with erect or curved culms, pubescent present when young.

Distribution : Eastern Himalaya ascending to 900 m and throughout N.E. Region.

Uses : Young shoots are eaten as vegetables by Mikirs and Garos.

15. *Dioscorea alata* L.

Large climber with quadrangular winged stem.

Distribution : Native of South-East Asia. Cultivated in all States of India.

Uses : Tubers are eaten by Tribals in most of the areas.

16. *Dioscorea pentaphylla* L.

Slender and prickly climber with 3-5 foliate leaves.

Distribution : Native of tropical Asia extending eastward to the island of the Pacific. Occurs throughout India ascending to 1800 m in the Himalaya and in Andaman Islands.

Uses : Tubers are eaten by forest dwelling population.

17. *Eclipta alba* (L) Hassk.

A herb with white flowers.

Distribution : Occurs in India.

Uses : A juice from young shoots is taken by Mikirs to reduce intestinal pains.

18. *Enhydra fluctuans* Lour.

Prostrate herb with opposite and sessile leaves.

Distribution : Found wild in Assam, Bengal and Bihar.

Uses : Plant is eaten as vegetables and believed to be good for stomach trouble.

19. *Eryngium foetidum* L.

An aromatic herb with spathulate and spinous leaves.

Distribution : Occurs in Assam upto an altituds of 1600 m.

Uses : Leaves used as spice in curry.

20. *Ficus hispida* L.

Small tree, all parts more or less hispid pubescent.

Distribution : India, Sri Lanka, Andamans, Burma and from the Malaya Peninsula to China and Australia.

Uses : The latex from the stem is used by the Mikirs to cure earache. Leaves are used as vegetables.

21. *Momordica charantia* L.

Climber with 5-7-lobed leaves, flowers yellow, fruits long, fusiform with numerous tubercles.

Distribution : Found wild and cultivated all over India, pantrepic.

Uses : Juice obtained from the crushed leaves applied externally for skin diseases.

22. *Premna latifolia* Roxb.

Tree, leaves hairy but not stellate.

Distribution : Sub-Himalayan tracts from Ravi eastwards.

Uses : Young tender leaves are eaten as vegetables by Garos.

23 *Scoparia dulcis* L.

A herb with small white flowers.

Distribution : Indigenous to tropical America and very commonly found as a weed in many parts of India.

Uses : Crushed leaves are applied in skin disease and swellings.

24. *Solanum indicum* L.

Erect prickly shrub, leaves ovate or oblong, flowers blue, berry small and orange colour.

Distribution : Throughout India ascending to 1500 m in Himalayas.

Uses : Fruits are eaten as vegetables.

25. *Solanum spirale* Roxb.

Unarmed herb with white flowers and globose berries.

Distribution : Found in the hills and plains of Assam, ascending to an altitude of 1200 m.

Uses : Used in the preparation of traditional wine by Mikirs.

26. *Thevetia peruviana* (Pers.) Merril.

Evergreen shrub with linear leaves, flowers pinkish-yellow. Drupe triangular.

Distribution : Native of tropical America and West Indies. Cultivated in garden throughout India.

Uses Latex obtained from the fruit is applied externally in nail-root infection.

Acknowledgement

Authors are thankful to the Principal and Head of Research, State Forest Service College-cum-Research Centre, Burnihat for providing facilities during the course of investigation.

SUMMARY

The paper deals with 26 Nos of medicinal and food plants of Burnihat Valley, Assam/Meghalaya being used by the local inhabitants. Most of the tribals of the area are Mikirs, Kacharis, Garos and Khasis. The present study provides the ethnobotanical account of plants and plant parts, alongwith their botanical names, local names, diagnostic characters and general distribution.

बर्नीहाट घाटी, असम / मेघालय के कुछ पादपों का नृऔद्भिदी अध्ययन

सस विश्वास व ए० अहमद

सारांश

इस अभिपत्र में बर्नीहाट घाटी, असम / मेघालय के 26 औषध और खाद्य पादपों की चर्चा है जिन्हें स्थानीय लोग उपयोग में लाते हैं। इस क्षेत्र में मिकिर, कछारी, गारों और खासी जन जातियां बसती हैं। प्रस्तुत अध्ययन में इन पादपों और पादप भागों का नृऔद्भिदी वर्णन, उनके वानस्पतिक नाम, स्थानीय नाम, पहचान करने के चिह्न और उनका सामान्य विस्तार बताए गए हैं।

References

Das, M.M. (1978). The peoples of Assam : An Introduction. Souvenir 48th Session, *Nat, Acad. Science* India, Gauhati University, Assam.

Hooker, J.D. (1872-1897). *Flora of British India.* Vol. *I-VII* London.

Kanjilal, P.C.; U.N. Kanjilal; A. Das, and R.N. Dey (1934-40). *Flora of Assam.* Vol *I-IV*, Shillong.

1987

———

BIRD ACTIVITY AND SEED PRODUCTIVITY IN THE CORAL TREE, *ERYTHRINA INDICA*

H. DANIEL WESLEY

Department of Zoology,
Bishop Heber College, Tiruchirapalli (Tamil Nadu)

Introduction

Many species of birds are known to help in pollination as they consume the floral parts and their secretions, the nectar. More than forty species are reported as visiting the coral tree to take nectar from its flowers (Ali, 1979). Sun birds at the mistletoe flowers (Gill and Wolf, 1975) and the humming birds in the pollination of *Heliconia* species (Stiles, 1975) have been studied. Pollen grains have been reported from the forehead of the drongo (Ali and Ripley, 1972).

With a view to knowing the bird species that would visit the coral tree in blossom and to assessing their efficiency as pollinators of the flowers, four cuttings of the tree were planted in a row 15 meters behind the house. Three years after planting, the trees were in blossom for the first time in January 1985. The total number of inflorescences for the four trees were counted and the number of flowers was estimated from the mean ± SD calculated for a sample of 30 inflorescences. On four days, i,e., 14, 15, 16 and 19 January 1985, the avian visitors to the flowers were observed for their kinds and numbers, the frequency of their visits and activities in the tree, from dawn to dusk : 06:00 to 18:00. A binocular 8 × 50 mm 6.5° was used. For the sake of convenience the period of observation was divided into two-hour sessions.

In the first week of March 1985, when there were fruits and no flowers at all, the number of inflorescences with fruits; of fruits to each inflorescene; of seeds in each fruit and inflorescence; and the total seeds for the trees, individually and collectively, were counted. Counting was feasible by the tell-tale inter-seed constrictions on the pods. Checking was done by collecting the fruits and counting the seeds indoors.

Observation

Avian visitors : Twelve species of birds (*Corvus splendens, C. macrorhynchos, Sturnus pagodarum, S. malabaricus, Acridotheres tristis, Pycnontus cafer, Passer domesticus, Turdoides caudatus, Dicrurus adsimilis, Nectarina lotenia, N. zeylonica* and *Oriolus oriolus*) visited the coral trees. The number of birds of each species in the trees at different periods on the four days of observation was as in Table 1 and 2. The duration of their stay, in minutes, in the trees are presented in Table 3.

All the visitors except *Dicrurus adsimilis, Nectarina zeylonica* and *Passer domesticus* took nectar from the flowers. The two crows damaged the flowers by trampling upon them and willfully cutting and dropping the petals down. The

Table 1

Activity pattern of 12 species of Birds in the Coral trees for 4 days in January 1985

Day	Time of Activity	Bird species												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
I	06.00-08.00	5	—	6	9	3	1	—	—	—	—	—	—	24
	08.00-10.00	10	—	14	6	5	—	1	—	—	—	—	—	36
	10 00-12.00	1	—	2	3	3	1	—	—	—	—	—	—	10
	12.00-14.00	—	—	1	—	—	—	—	—	—	—	—	—	1
	14.00-16.00	—	—	—	—	—	—	—	—	—	—	—	—	—
	16.00-18.00	—	—	—	—	—	—	—	—	—	—	—	—	—
Total		16	—	23	18	11	2	1	—	—	—	—	—	71
II	06.00-08.00	13	3	12	3	7	2	—	3	1	—	—	—	44
	08.00-10.00	3	—	9	4	9	1	—	—	—	—	—	—	26
	10.00-12.00	—	—	4	2	6	2	—	—	—	—	—	—	14
	12.00 14.00	—	—	2	—	3	—	—	—	—	—	—	—	5
	14 00-16.00	—	—	—	—	—	—	—	—	—	—	—	—	—
	16 00-18.00	4	—	2	—	—	—	—	—	—	—	—	—	6
Total		20	3	29	9	25	5	—	3	1	—	—	—	95
III	06.00-08.00	7	—	5	—	8	1	—	—	—	—	—	—	21
	08.00-10 00	5	1	9	4	4	1	—	—	—	—	—	—	24
	10.00-12.00	—	—	6	—	2	—	—	—	—	—	—	—	8
	12.00-14.00	7	—	3	—	—	1	—	—	—	—	—	—	11
	14.00-16.00	1	—	—	—	3	—	—	—	—	—	—	—	4
	16.00-18.00	—	—	—	—	—	—	—	—	—	—	—	—	—
Total		20	1	23	4	17	3	—	—	—	—	—	—	68
IV	06.00-08.00	8	—	11	6	3	1	—	—	—	—	—	—	29
	08.00-10.00	4	3	10	—	2	4	—	—	—	1	—	—	24
	10.00-12.00	1	—	3	5	2	—	—	—	3	—	—	1	15
	12.00-14.00	—	—	4	4	1	—	—	—	—	—	1	—	10
	14.00-16.00	—	—	2	—	—	—	—	—	—	—	—	—	2
	16.00-18.00	6	—	2	—	—	—	—	1	—	1	—	—	10
Total		19	3	32	15	8	5	—	1	3	2	1	1	90
Grand Total		75	7	107	46	61	15	1	4	4	2	1	1	324

Table 2

Activity (%) of 12 Avian species in the Coral trees on 4 days in January 1985

Species		Day 1	Day 2	Day 3	Day 4	Total	Species (%)
1	No.	16	20	20	19	75	
	%	22.5	21.00	29.41	21.11		23.15
2	No.	—	3	1	3	7	
	%	—	3.20	1.47	3.33		2 20
3	No.	23	29	23	32	107	
	%	32.4	30 52	33.82	35.56		33.02
4	No.	18	9	4	15	46	
	%	25.4	9.47	5.89	16.67		14.20
5	No.	11	25	17	8	61	
	%	15.5	26.31	25.00	8.89		18.80
6	No.	2	5	3	5	15	
	%	2.8	5.3	4.41	5.56		4.63
7	No.	1	—	—	—	1	
	%	1.4	—	—	—		0.31
8	No.	—	3	—	1	4	
	%	—	3.15	—	1.11		1.23
9	No.	—	1	—	3	4	
	%	—	1.05	—	3.33		1.23
10	No.	—	—	—	2	2	
	%	—	—	—	2.22		0.61
11	No.	—	—	—	1	1	
	%	—	—	—	1.11		0.31
12	No.	—	—	—	1	1	
	%	—	—	—	1.11		0.31
Total	No.	71	95	68	90	324	
	%	100	100	100	100		100

Table 3

Duration (in minutes) of Bird activity in four Coral trees

Bird Species	Days 1	2	3	4	Total	(%)
	Minutes					
Corvus splendens (House crow)	104	149	156	153	562	16.86
Corvus macrorhhynchos (Jungle crow)	—	22	5	8	35	1.05
Sturnus pagodarum (Black-headed myna)	313	224	278	423	1238	37.15
Sturnus malabaricus (Grey-headed myna)	180	271	249	86	786	23.58
Acridotheres tristis (Indian myna)	92	297	126	68	583	17.49
Pycnonotus cafer (Red-vented bulbul)	9	43	4	17	73	2.19
Passer domesticus (House sparrow)	1	—	—	—	1	0.03
Turdoides caudatus (Common babbler)	—	10	—	20	30	0.90
Dicrurus adsimilis (Black drongo)	—	1	—	18	19	0.57
Nectarina lotenia (Loten's sunbird)	—	—	—	2	2	0.06
N. zeylonica (Purple-rumped sunbird)	—	—	—	1	1	0.03
Oriolus oriolus (Golden oriole)	—	—	—	3	3	0.09
Total	699	1017	818	799	3333	100.00

red-vented bulbul was a damager of the floral parts in as much as it ripped the buds open at the base and the apex, and also ate the anthers from the open flowers.

The common house crow disturbed the others often. Among the mynas, the black-headed myna and the Indian myna would not tolerate the grey-headed myna, while the latter, while alone, would engage in intra-specific skirmishes. The two bigger mynas and the house crow took occasional baths in the nearby puddles

Floral and seed counts

The number of inflorescences counted in all the four trees was 384; tree-wise it was 99, 134, 40 and 111. For 2025 flowers of 30 inflorescences the mean ± SD was 67.5 ± 23.38. There were, then, 25,920 flowers; tree-wise the distribution was 6682.5, 9045, 2700 and 7492.5 respectively.

The fruiting pattern and the seed distribution among the fruits were as in Table 4 and 5.

Table 4

Fruiting pattern in 97 inflorescences

Fruit per Inflorescence	Trees				No. Inflorescence	Fruits Total
	1	2	3	4		
	No. Inflorescence					
1	2	23	2	10	37	37
2	1	8	—	12	21	42
3	1	6	3	7	17	51
4	1	6	1	2	10	40
5	—	3	—	4	7	35
6	—	2	—	2	4	24
7	—	—	—	1	1	7
Total	5	48	6	38	97	236

Table 4a

Fruiting pattern per inflorescence – %

Fruits/ Inflorescence	No. Inflorescence	No. Fruits	Inflorescence (%)
1	37	37	38.14
2	21	42	21.65
3	17	51	17.53
4	10	40	10.31
5	7	35	7.22
6	4	24	4.12
7	1	7	1.03
Total	97	236	100.00

Table 5

Seed distribution in 236 fruits of four Coral trees

Seeds per Fruit	Trees				No. Fruits	No. Seeds
	1	2	3	4		
	No. Fruits					
1	1	10	6	8	25	25
2	4	36	3	28	71	142
3	4	23	1	24	52	156
4	2	24	2	20	48	192
5	—	11	2	14	27	135
6	—	4	1	5	10	60
7	—	—	—	3	3	21
Total	11	108	15	102	236	731

Table 5a

Seed distribution/fruit · %

Seeds/Fruit	No. Fruits	No. Seeds	Fruits (%)
1	25	25	10.59
2	71	142	30.10
3	52	156	22.03
4	48	192	20.33
5	27	135	11.44
6	10	60	4.24
7	3	21	1 27
Total	236	731	100.00

Many a bud was lost as the terminal portions of the inflorescences withered away early. The total flowers lost this way was estimated at 1317, the mean ± SD for 14 inflorescences being 34.28 ± 4.64. The number of viable flowers, therefore, was 24,603.

Discussion

Considering the number of flowers produced by the coral trees under investigation, the seed production was poor (Table 5–5a). On the whole only 2.82% fertility was recorded. The flowers lost through the withering of the terminal buds minused,

the percentage of seed production would be raised to 2.97. It might be that pollination had not taken place to the extent possible. Of the 384 inflorescences only 97 bore fruits : 25.26%. The fruiting pattern was peculiar in that the inflorescences bearing single fruits were more than the others which decreased steadily (Tables 4 and 4a). Two seeded-fruits were the most abundant (Tables 5 and 5a).

The birds had been frequenting the flowers only during the early hours of the day and the trees were almost without active pollinators in the post-meridian hours (Table 1). The bathing by the house crows, the Indian myna and the black-headed myna, and the rain on 16 January 1985 may have washed off the pollen from the feet and the heads of these birds. The deliberate destruction of the floral parts and the constant intraspecific and inter specific bickerings and taunting must have added to the wastage of the pollen.

It may be noted that the black-headed myna was the commonest of the birds in the coral trees, closely followed by the house crow, the Indian myna and the grey-headed myna.

The coral tree is not of great economic importance. It is being used as a wind-break and its foliage as fodder for domestic animals. That it can be grown from cuttings makes this study of little consequence. The fact that single-fruit inflorescences and two-seeded fruits were more numerous than those with higher counts suggests a cytogenetic break-down which would be worth investigating into.

Conclusion

The coral flowers attract quite a large number of birds from the vicinity. They are occupied mostly during the first half of the day. Much pollen is wasted through wilful damage caused to floral parts and poor pollination. Added to this, the low fertility is likely to be due to cytogenetic factor, the wilting and withering of the terminal flowers apart.

Acknowledgement

I should thank my little daughter, Glada, for helping me in the counting of the flowers and seeds, and the others in the family for their patience. My special thanks are due to Dr. A. Gnanam, Vice-Chancellor, Bharathidasan University, Tiruchirapalli for going through the manuscript.

SUMMARY

The activities of birds for their efficiency as pollinators in four coral trees in blossom in January 1985 were observed for four days. A pair of binoculars was used. Initially, the total number of inflorescences in all the four trees was counted and that of the flowers estimated from a sample of 30 inflorescences; the mean ± SD : 67.5 ± 23.38. There were 384 inflorescences with 24,603 flowers. Later, the fruits and seeds were counted physically. The number of seeds produced was a mere 731, a poor 2.97%. Of the twelve species of birds that visited the

flowers, *Sturnus pagodarum* was the commonest. Deliberate destruction of floral parts, inter- and intraspecific competition among the visiting species and a probable cytogenetic factor are reckoned as the cause for the low fertility observed.

कोरल वृक्ष—एरिथ्रिना इण्डिका में पक्षी सक्रियता और बीज उत्पादकता

एच० डेनियल वेजले

सारांश

चार पुष्पित कोरल वृक्षों में निवेचक के रूप में कार्यदक्षता के लिये पक्षियों की सक्रियता का जनवरी 1985 में चार दिनों तक पर्यवेक्षण किया गया। इसमे दूरबीन की सहायता ली गई। प्रारम्भ में चार वृक्षों पर आए पुष्पविन्यास की कुल संख्या को गिन लिया गया और कुल फूलों की संख्या का अनुमान 30 पुष्पविन्यासों के नमूनों से लगाया गया—मध्यक-मानक विचलन : 67.5 ± 23 38 । कुल पुष्पविन्यास 384 थे जिनमें प्रत्येक में 24 603 फूल थे। बाद म फल और बीज गिने गये। बीज केवल 731 बने, घटिया 2.97%। इन फूलों पर आने वाली बारह पक्षीजातियों में सबसे अधिक आम स्टुर्नस पैगोडेरम रही। पुष्प भागों को जानबूझ कर विनष्ट करना, पेड़ों पर आने वाले पक्षिओं में और पक्षी जातियों में आपस में स्पर्धा और संभावित कोशाजाननिक कारक इस पर्यबेक्षित निम्न उर्बरता के कारण कहे जा सकते हैं।

References

Ali, Salim and S.D. Ripley (1972). Hand-book of the Birds of India and Pakistan. Vol. 5. Oxford Uni. Press, Bombay.

Ali, Salim (1979). The Book of Indian Birds (11th Edn.). BNHS, Bombay.

Gill, F.B. and L.L. Wolf (1975). Foraging strategies, energetics of East African Sunbirds at mistletoe flowers: *Am. Nat.* 109 : 491-510.

Stiles, F.G. (1975). Ecology, flowering Phenology and humming bird pollination of some Costa Rican *Heliconia* species. *Ecology* 56 : 285-301.

RESEARCH NOTES
(I)

A NOTE ON THE GRASS PRODUCTION UNDER *CEDRUS DEODARA* FOREST IN HIMACHAL PRADESH

Forest grazing is said to be older than civilisation. Our forests are under great pressure of grazing and the structure and function of these forests are immensely influenced by the period and intensity of grazing. Continuous grazing on the same areas by large herds has adversely effected regeneration, caused soil erosion, infiltration and runoff. At high altitudes in hilly regions, the grasslands are scanty and forest lands have been looked upon as a principal source of grazing for domestic cattles, sheeps and goats. Grass covers below the tree canopy helps tremendously in soil and water conservation and may provide much needed forage if intensity of grazing is controlled. In fact, we do not have any quantitative measurements about the grass production, under different forest types, which is one of the important forest produces and support our domesticated livestock wholly or partially. Due to lack of any quantitative information on the productivity of these understorey grasslands, we have little knowledge on the production of grass from these areas. Thus, an attempt has been made to quantify the grass production under *Cedrus deodara* forest in Himachal Pradesh.

An area of 498.40 m^2 was closed and fenced during August, 1979, in pure *Cedrus deodara* stand in Shillaroo, 55 km from Shimla towards north at an elevation of 2400 m, for conducting interception studies. Twenty-five quadrats (1 × 1 m) were randomly laid down in this area and grasses were harvested in November, 1980 and, 1981 respectively for dry weight estimation. Thus the data presented in this note is the average of two years production figures. Water use efficiency of mixed grasses was calculated using the formula—water use efficiency as a ratio of annual aboveground net production (g/m^2) to annual rainfall (mm) (Singh and Joshi, 1977). Rainfall was recorded by the self-recording rain gauge installed at the site. Grass samples were dried in oven for dry weight estimation.

The value of annual net production (g/m^2/yr) of these mixed grasses was observed to be 311.00 g/m^2/yr. The total value of grasses production on a per hectare basis was estimated to be 3110.00 kg/ha or 31.10 quintal/ha. When the cost of these grasses are calculated @ Rs. 60.00/quintal, then total value in terms of cash comes to Rs. 1860.00 ha/yr. The rate of dry grasses in Shimla and other parts of the State varies upto from Rs. 60.00 to 80.00/quintal during summer season. This data of annual net production of mixed grasses can be compared very well with other mixed grasses data collected at different places. The

following Table 1 will give an idea of grass production and water use efficiency of differen t grassland type in different region of India.

From the data presented in Table 1, it is clear that the grass production under deodar forest is more than the mixed grass production at Rajkot, Jodhpur, Pilani, Udaipur and less than Ambikapur and Ratlam. Water use efficiency varied from 0.29 (Udaipur) to 0.92 (Rajkot). There seems to be apparently no direct relation between annual rainfall and water use efficiency except the tendency of higher efficiency in medium rainfall areas.

Table 1

Site	Grassland type	ANP ($g/m^2/yr$)	Rainfall (mm/yr)	Water use efficiency ANP/rainfall	Source
Rajkot	*Cenchrus ciliaris*	224	242	0.92	Pandeya (1974)
Jodhpur	Mixed grass	164	311	0.52	Gupta *et al* (1972)
Pilani	Mixed grass	217	391	0.55	Kumar & Joshi (1972)
Udaipur	Mixed grass	184	627	0.29	Vyas *et al* (1972)
Ratlam	Sehima	433	1257	0.34	Billore (1973)
Ambikapur	Mixed grass	436	1379	0.31	Naik (1973)
Shillaroo (H P.)	Mixed grass	311	841	0.37	Present study

References

Billore, S.K. (1973). Net Primary production and energetics of a grassland ecosystem at Ratlam, India. *Ph D. Thesis.* Vikram Uni Ujjain.

Gupta, R.K., S.K. Saxena & S.K. Sharma (1972). *Aboveground productivity of grassland at Jodhpur.* P.M. Golley and F.B Golley (ed). p. 75-94.

Kumar, A. and M.C. Joshi (1972). The effect of grazing on the structure and productivity of vegetation near Pilani, Rajasthan, India. *J. Ecol.* 60 : 665-675.

Naik, M.L. (1973). Ecological studies on some grasslands of Ambikapur. *Ph.D. Thesis.* Saugar, Uni. Sagar, India.

Pandeya, S.C. (1974). *Autecology and Genecology of Anjan grass (Cenchrus ciliaris) complex.* 2nd Progress report of the findings, PL 480 Research Project. Saurashtra Uni. Rajkot.

Singh, J.S. and M.C. Joshi (1977). *Primary production. R.T. Coupland (ed.) Grassland ecosystems of the world : their analysis and uses.* Cambridge Uni. Press.

Vyas, L.N., R.K. Garg and S.K. Aggarwal. (1972). *Net aboveground production in the monsoon vegetation at Udaipur.* P.M. Golley and F.B. Golley (ed.) p. 95-100.

Environmental Research Station,
Shimla (Himachal Pradesh)

R.P. Singh

———

(II)

A NOTE ON SEEDLING ABNORMALITY FREQUENCY IN THE HALF-SIB PROGENIES OF *SANTALUM ALBUM*

Santalum album is a scented essential oil-yielding plant and grows wild in southern India. The oil is obtained in the heart-wood of the plant. The total oil content of the tree together with the quantum of oil per unit gram of wood varies considerably indicating the oil content to be a genetically controlled character. Attempt is underway to improve the oil-content of the tree. The improvement may be made through breeding and by applying suitable selection method. It is therefore necessary to know the breeding pattern of the species, either cross-fertilised, self-fertilised or partially cross or self-fertilised. Depending on the breeding behaviour, the selection method may be adopted.

Seedling variation was previously reported by Srimathi and Kulkarni (1983 a, 1980 b). However, a detailed analysis was restricted. Chlorophyll and other abnormalities were studied in teak (*Tectona grandis*) by Bagchi and Emmanuel (1983). In the present investigation, seeds of selected trees were sown to grow seedlings for further experiment, where different types of abnormalities together with their frequencies were noted and are presented here.

Seeds of ten selected trees K30, K23, K34, K14, K2, K26, KL1, KL3, AP4 and K33 were dehusked and were sown in polythene boxes containing thoroughly washed sand. During dehusking K30 and K23 seeds were found to be bad in quality and during germination, rodents attacked these two particular seed-lots Therefore the K30 and K23 seed lots were excluded from the experiment.

The dehusked seeds of each variety were sown as per randomised block design with four replications. In four replications eight beds each were prepared and genotypes were allotted to the beds at random leaving one hundred seeds from each tree per bed per replication. Seeds were sown on 20-5-85 and the boxes were kept in the glass-house. Watering was done at regular intervals. Germinations noted on 15-6-84 and abnormalities noted during transplantation between 19-7-84 to 22-7-84. One or two twin seedlings were present in the whole of the lot, which were inadvertently lost and thus were not included in the table. However, as the frequency is very less, it is assumed that it may not grossly disturb the computed frequency percentages. Replications were pooled to compute the data.

It may be seen from the table that the abnormalities are of various types, such as, (1) rootless, (2) tri leaved, and (3) branchy.

It is understood from the table that the mean per cent abnormality is around 7%,

Details of abnormal seedlings

Tree number	No. of seeds	Seedlings trans-planted	Rootless seedlings	Tri-leaved seedlings	Branched seedlings	Abnormality	
						Total	Percentage
K34	400	151	3	3	nil	6	3.97
K33	400	128	nil	7	nil	7	5.47
KL1	400	149	nil	14	nil	14	9.40
AP4	400	190	nil	8	nil	8	4.21
K2	400	124	3	14	nil	17	13.71
K26	400	234	nil	19	nil	19	8.12
K14	400	202	1	13	nil	14	6.93
KL3	400	174	nil	6	1	7	4.02
Total	3200	1352	7	84	1	92	55.83
Mean	400	169	3.5	10.5	—	11.5	6.98

with a minimum of 3.97 and a maximum of 13.71. It is therefore clear that significant differences exist among plants for throwing abnormal seedlings. This may be due to the effect of self-fertilisation. Non-germination of seeds and higher rate of mortality at the seedling stage are also the indications of self-fertilisation.

In the present investigation, it was observed that, (1) difference exists in exhibiting per cent abnormality, indicating a possible genetic control of the phenomenon, (2) presence of a higher percentage (6.98%) of abnormality in the half-sib populations might indicate the presence of self-fertilisation, which has crossed the threshold limit, becoming deleterious in nature.

References

Bagchi, S.K. and C J.S.K. Emmanuel (1983). Chlorophyll and other abnormalities in *Tectona grandis* L. *Myforest* 19 (4) : 209-213.

Srimathi, R.A. and H.D. Kulkarni (1983a). Progeny trials of selected trees in *Santalum album* L.– Variation in seedlings. ISTS Symposium, Improvement of Forest Biomass. Ed. by P.K. Khosla, at F.R.I. and Colleges, Dehra Dun, April 11-12.

.. .. (1980b). Triplet seedlings in Sandal (*Santalum album* L.) *Indian For.*, **106** 12 : 842.

*Genetics Branch,
Forest Research Institute and Colleges, Dehra Dun.
and
**Sandal Research Centre, Bangalore.

S.K. Bagchi*
and
H.D. Kulkarni**

LETTER TO THE EDITOR

To,

The Hony. Editor,
Indian Forester,
P.O. New Forest,
Dehra Dun.

Sub. : **Nilgai having dewlap like Goat**

Sir,

All about November 1975 when searching for dens of the Striped Hyena (*Hyaena hyaena*) in the Tallagudi forest in the buffer zone of Nawegaon National Park (Bhandra District), I observed a male Nilgai (*Boselphus tragocamelus*) grazing in the forest sparsely dotted with trees a pair of dewlap as found under the neck of a goat was observed through a pair of binoculars. The bull was tawny in colour.

I enquired with local Shikari, Gond and Gowari tribals about the dewlap. They too confirmed seeing such dewlap among the Nilgai (male) though rarely and they will be known as Larya Nil meaning the teat like process under the neck.

Sd./- M.B. Chitampalli
Deputy Director
Tiger Project Melghat
Paratwada,
Distt. Amravati (Maharashtra)

Dated 26-8-1987

———

OBITUARY

Goura Mohan Das

(1928-1987)

Mr. Das was born on 29th September, 1928. He stood 7th in the Matriculation Examination and had brilliant academic career thereafter and joined Indian Forest College, Dehra Dun in 1948. He served the Orissa Forest Department from 1950 for a long period of 37 years and was superannuated on 30th September, 1986. He was selected into IFS as an initial recruit and served in various capacities as Chief Wild Life Warden, Managing Director, Similipahar Forest Development Corporation Ltd. and Chief Conservator of Forests - in - Charge of departmental collection and processing of Kendu Leaf before retirement. He was reputed as good man-manager due to his innate ability to understand the sentiments of his superiors, colleauges and subordinates alike. He imbibed the charming quality to make a stranger very near and dear within very short time. He also had an uncanny style of his own to solve serious problems by simple methods without hurting anybody's sentiment.

Born in a family of lawyers he had an ambition of joining legal profession during post-retirement life and so he had graduate in Law late in his career while serving in Govt. But as ill-luck would have it, severe ailments overtook him about 18 months before his retirement and almost crippled him till his sad demise on 24th July '87.

Amiable and jovial, Shri Das was popular with all sections of Forest officers and staff. His untimely sad demise has shocked all his relations and friends alike. He is survived by his devoted wife, three daughters and two sons who are well settled in their lives.

May his soul rest in peace.

S.C.P.

GAZETTE NOTIFICATIONS

F.R.I. GAZETTE

The President, Forest Research Institute & Colleges, Dehra Dun has replaced the services of Shri L.N. Chaki working as Assistant Instructor, Eastern Forest Rangers College, Kurseong at the disposal of Government of West Bengal with effect from 9-5-1987 (A.N.)

KARNATAKA GAZETTE

On his reversion to the State Cadre, services of Shri P.K. Devaiah, IFS, are placed at the disposal Animal Husbandry, Fisheries and Forest Department for appointment as General Manager, Karnataka Cashew Development Corporation Limited, Mangalore vice Shri A.S. Kumar, IFS, transferred, with immediate effect and until further orders.

WEST BENGAL GAZETTE

The Governor is pleased to appoint, until further orders, Shri Satyananda Das, W.B.F.S., Divisional Forest Officer, Siliguri Social Forestry Division as Divisional Forest Officer, Working Plans (South) Division-II, Bankura with effect from the date of his assuming charge.

The Governor is pleased to appoint, until further orders, Shri L.N. Chaki, W.B.F.S., an officer on compulsory waiting, as Divisional Forest Officer, Siliguri Social Forestry Division with headquarters at Siliguri with effect from the date of his assuming charge.

FRI Publications

FOREST RESEARCH INSTITUTE & COLLEGES, DEHRA DUN

The Common Commercial Timbers of India and their uses, by H. Trottler (Reprinted 1982). (Symbol No. PFRI. 92). Price Rs. 27.00 or £ 3.75 or $ 9.72.

A Review of the Classification of timbers for different end-uses, by S.S. Rajput and N.K. Shukla (Symbol No. PFRI. 208). Price Rs. 6.50 or £ 0.76 or $ 2.34.

Indian Woods : Their identification, properties and uses, Vol. V Oleaceae to Santalaceae, by S.K. Purkayastha. (Symbol No. PFRI. 201) Price Rs. 138.50 or £ 16.15 or $ 49.86.

Troup's Silviculture of Indian Trees, Vol. IV (Revised 1983). (Symbol No. PFRI. 188). Price Rs. 118.50 or £ 18.82 or $ 42.66.

Troup's Silviculture of Indian Trees, Vol. VI (Revised, 1985). (Symbol No. PFRI 206). Price Rs. 64.00 or £ 7.47 or $ 23.04

Annotated Bibliography on Bamboos, by N.K. Mathur and A.K. Sharma. (Symbol No PFRI. 211). Price Rs. 93.00 or £ 10.85 or $ 33.48.

Proceedings of the Second Forestry Conference, Dehra Dun, January, 16-19, 1980, Vol. I ed. by N.K. Mathur (Symbol No. PFRI. 199). Price Rs. 20.00 or £ 2.33 or $ 7.20.

Proceedings of the Second Forestry Conference, Dehra Dun, January. 16-19, 1980, Vol. 2, ed. by N K. Mathur (Symbol No. PFRI. 203). Price Rs. 275.00 or £ 32.31 or $ 99.00.

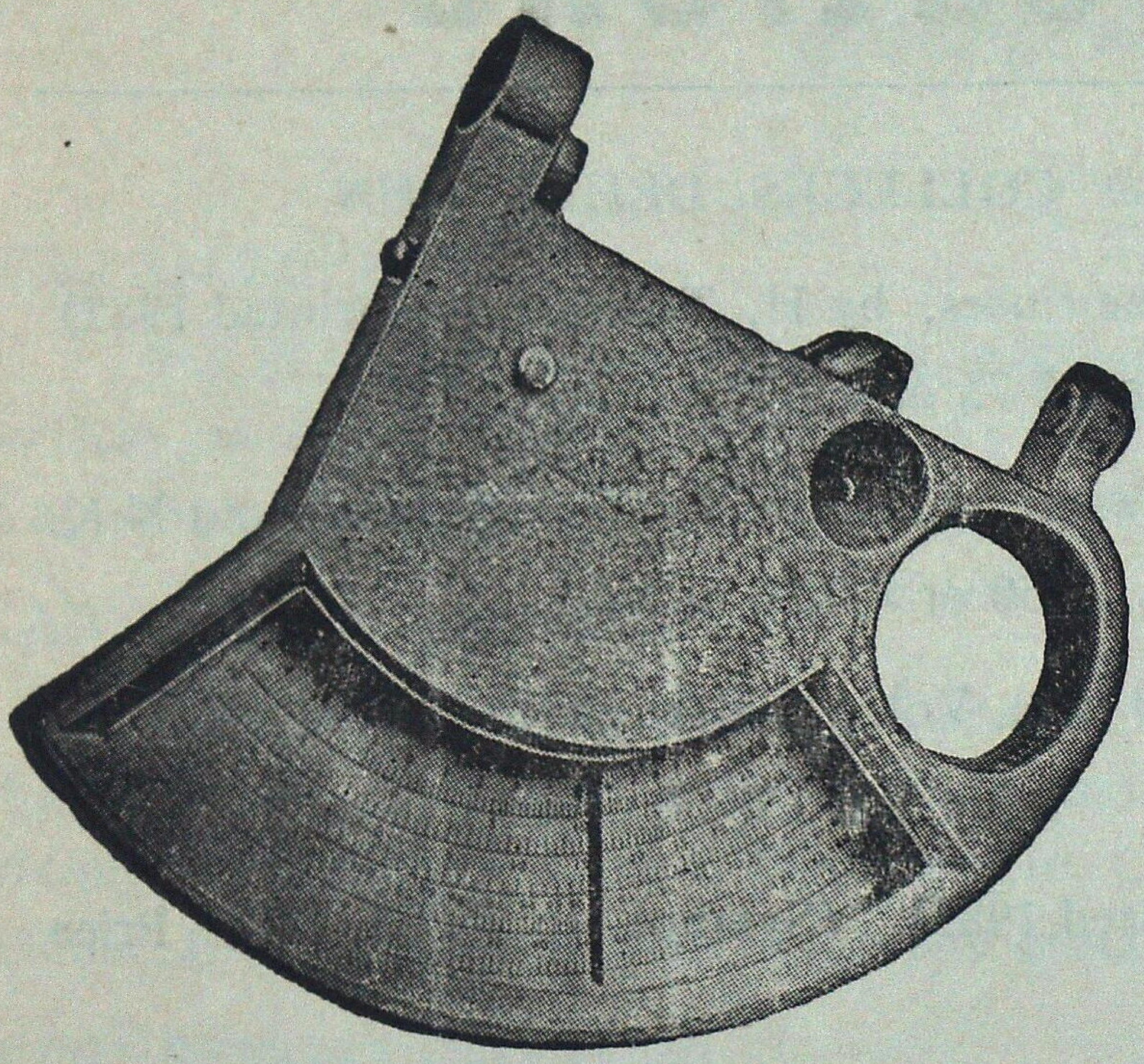
Proceedings of the First Forestry Conference, Dehra Dun, December, 6-10, 1973, Vol. 2. (Symbol No. PFRI. 181. Vol. II). Price Rs. 183.00 or £ 21.34 or $ 65.88.

Indian Forest Leaflet No. 198 (New Series) W. W. S. M. &. F. Economic Conversion of Logs Part III by B.S. Rawat & K.L. Arora (Symbol No. PFRI.-195, 535-1981 (DSK. III) Price Rs. 6.00 or £ 0.70 or $ 2.16.

Available from :

The Controller of Publications,
Department of Publication,
Civil Lines, Delhi-110054.

Primier manufacturing house of quality forestry instruments offers



RAVI MULTIMETER

(Patent A Nos. 000191, 000192 & 000222)

A must for every Forest Officer

Ravi Multimeter gives heights of individual trees in plain or in sloping grounds, Basal Area for four factors 0.5, 1.0, 2 0 and 3.0 in metric units, Average Crop Height and Base Line, A very useful instrument for Working Plan, Pre-Investment Survey and Silvicultural Divisions.

Appreciated and being used by Forest Deparments all over India.

RAVI ALTIMETER

(Patent A No. 000191)

For measurement of heights of individual trees in plain or sloping grounds

LIGHT WEIGHT
SINGLE LEGGED LADDER

Available in 12 sections each of 2.5 m in length (one base section, ten mid sections and one end section) Any height upto 30 m can be conveniently reached by adjusting numbers of mid sections. Simple to assemble and light to carry. Useful in measurement of standing sample of trees and in plucking of seeds, Leather safety belt for use of climber available separately.

Aluminium Double Legged Ladders of various specifications.

* * * *

Tree Callipers (Aluminium, wooden and metal bound) of various sizes.

* * * *

Increment Borers, Fixed Iron Callipers, Bark Gauges, Tree Scribe (Bark Scrapper), Abney's Level, Topographic Abney's Level, Metallic and Steel Tapes, Bow Saws. Wedge Prisms and other Scientific Drawing and Surveying Instruments.

For further particulars please contact :—

Phone : 26636

RAVI VAGYANIK YANTRA NIRMATA

BHAGWAN DASS BUILDINGS, JUGMANDER STREET,

DEHRA DUN (U.P.) 248 001

With best compliments

from

WOOD PRESERVERS PVT. LTD.,

F-27, MIDC INDUSTRIAL ESTATE,
NAGPUR-440 016 (MAHARASHTRA).

GRAM : WOODTREAT

PHONE : FACT. 7451, 7210
RESI. 23131

Manufacturers for :

"Railway Sleepers, Pre-cut structurers, Marine Constructions materials, Fabricated and engineered wood products, Wood Preservative Copper Chrome Arsenic Composition, Kiln drying Pressure Preservation treatment, Ammunition Boxes, Wooden Pallets, Packing cases and Crates."

"Enquiries particularly solicited for unusual and difficult items."

The Similipahar Forest Development Corporation Ltd.

(A GOVERNMENT OF ORISSA UNDERTAKING)

BARIPADA

S.F.D.C.

ORISSA

Our Corporate goal is

- ★ To preserve and protect the Similipahar Forest ;
- ★ To improve and enrich the growing stock, and to nurse back to health the degraded patches in the project area ;
- ★ To improve infrastructure like roads, godowns, rest house and staff quarters; and
- ★ To intensify collection of M.F.P.

We have grown from a turnover of Rs. 43 lakhs during 1979-80 to Rs. 580 lakhs during 1981-82.

WHATEVER YOUR NEED

There is a Species of

ANDAMANS TIMBERS

TO SUIT YOUR REQUIREMENTS

CONTACT :

1. The Chief Conservator of Forests,
Andamans & Nicobar Islands,
Port Blair.

2. The Deputy Conservator of Forest
(Depot Division)
Andamans Govt. Timber Depot,
3-A, 2nd Floor, Auckland Place,
Calcutta-17.

3. The Assistant Conservator of Forests,
(Depot Division)
Andamans Govt. Timber Depot
Marshalling Yard, Port Trust, MADRAS.

CORBETT NATIONAL PARK, RAMNAGAR (NAINITAL) U.P.

Beckons you to its land of Roar, Trumpet and Song.

Have a date with nature in its superb magnificence and enjoy the thrill of observing wild animals roaming freely in the vast wilderness. A paradise for bird watchers and anglers.

Elephants, chital, sambar, hog deer, barking deer, wild boar, magar gharial etc. and incredibly large varities of numerous beautiful birds. There is also very good chance of seeing tiger, panther or a bear in their natural habitat.

* Elephant rides arranged at reasonably low rates.
* Still photography permitted free; cine photography on nominal payment.
* Angling permitted on moderate charges in the Ramganga river which abounds in famous fighting fish 'Mahaseer'.
* High watch towers and tree top machans available for wildlife viewing.
* Picturesque scenery of the park provides an ideal holiday resort.
* Wildlife films screened daily free of charge.
* Well furnished Rest Houses and lodges available at various tourist centres inside the Park.
* Regular bus service available from Ramnagar to main tourist centre (Dhikala).

Nearest Rail Head—Ramnagar (N.E. Rly)
Nearest Bus stop—Ramnagar
} 50 kms from Dhikala

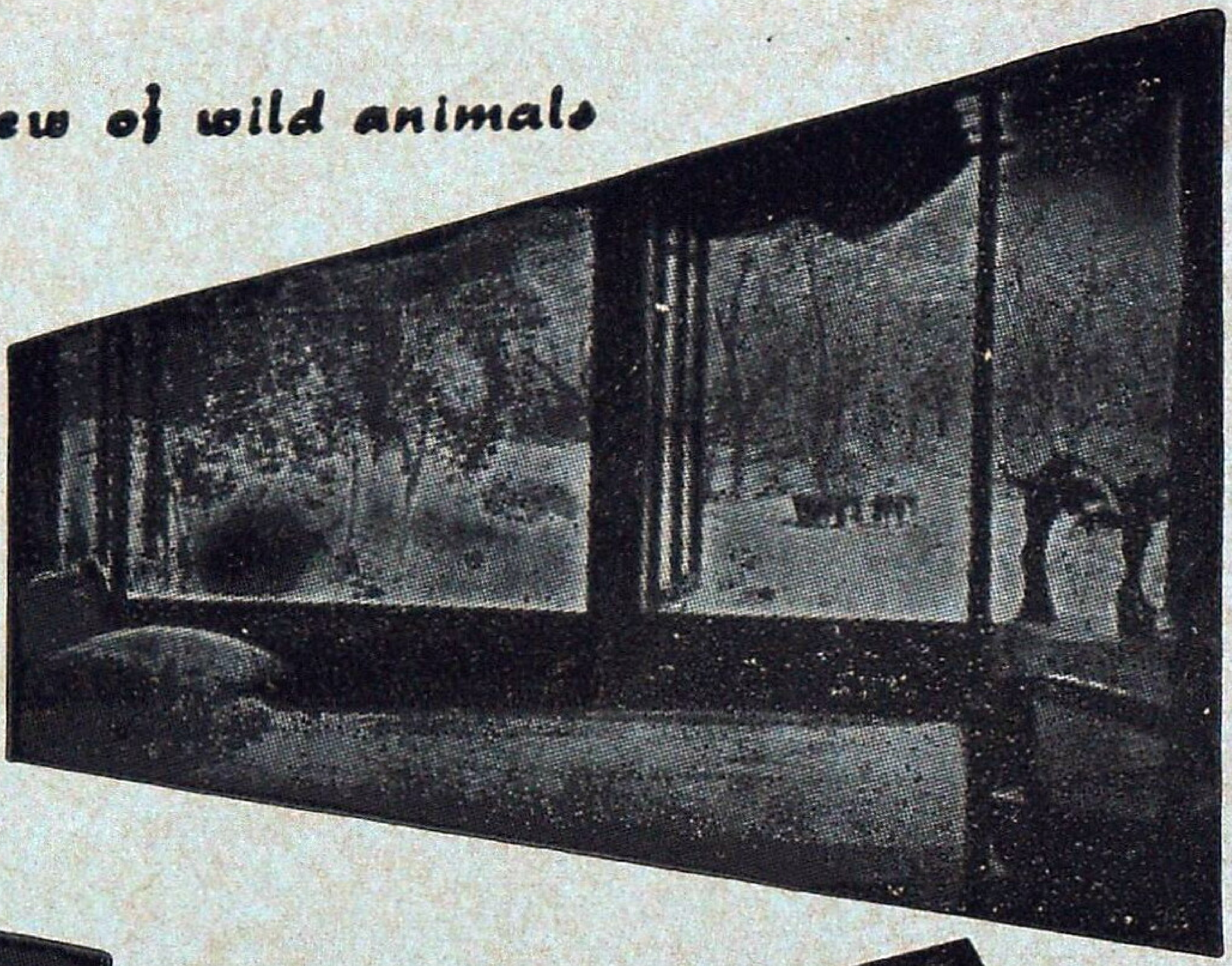
Eor other information contact or write to :

The Field Director, Project Tiger
Corbett National Park,
Ramnagar (Nainital), U.P.—244715
Phone : 32, 189 Office
76—Residence

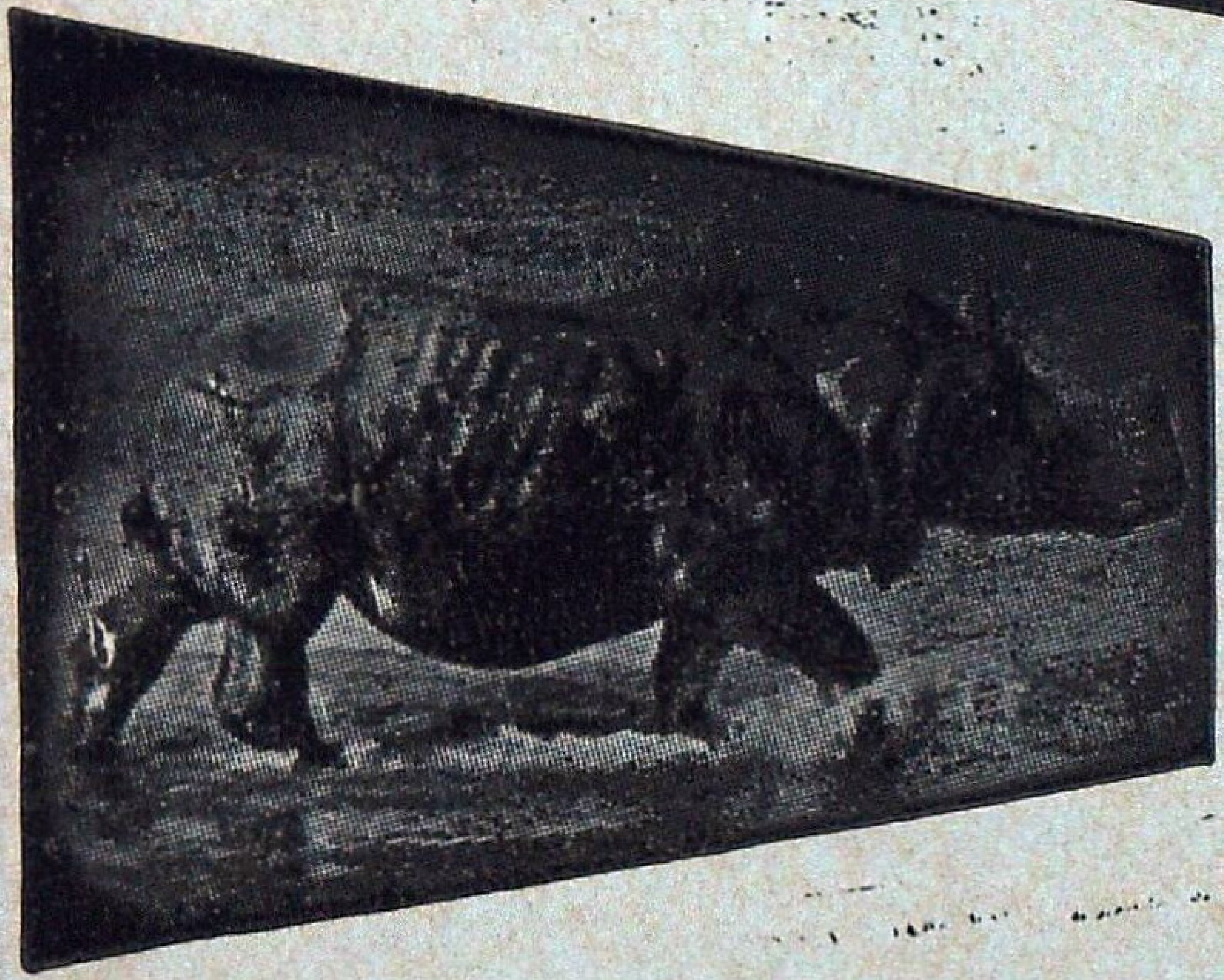
OR

The Chief Wildlife Warden
17-Rana Pratap Marg,
Lucknow (U.P.)
Phone : 46140—Office
46817—Residence

Have a bedroom view of wild animals



VISIT



JALDAPARA WILD LIFE Sanctuary

* Home of One-horned Rhinoceros.
* Gaur, Elephants, Tigers.
* Varieties of Deer and other Animals.
* Furnished Tourist Lodges with full Catering arrangement.
* Approachable by Road, Train and Air.
* Jeep available.

Please contact :

DIVISIONAL FOREST OFFICER
WILD LIFE DIVISION–II
JALPAIGURI
(WEST BENGAL)

OR

FOREST UTILISATION OFFICER
8, Lyons Range, CALCUTTA
[Phone : 22-2774]
WEST BENGAL

Punjab State Forest Development Corporation Limited

REGD OFFICE : KOTHI No 165, SECTOR 36-A, CHANDIGARH. Tel. : 40586

Punjab State Forest Development Corporation Limited has established the use of eucalyptus wood in building construction, truck body building, furniture making, battens, wooden crates, fabrication of packing cases, tool handles etc. Besides its use in paper and pulp industries the eucalyptus wood is also suited for chip / particle / fibre / ply-boards. Investigations got done from the Indian Plywood Industries Research Institute, Bangalore have shown that the eucalyptus timber grown in Punjab is suitable for making common grade plywood. Entrepreneurs desirous of setting up wood based industries can do so as huge quantity of eucalyptus wood is available at reasonable price in the State. The Corporation has wood seasoning facilities at its Phillaur complex.

Recently, the Corporation has established the use of eucalyptus on commercial scale in fabrication of packing cases and manufacturing door and window frames.

For further details, please contact the Managing Director, Punjab State Forest Development Corporation Limited, Chandigarh.

Y.P. CHOWDHRY
MANAGING DIRECTOR

Versatile Eucalyptus

BY

B.K.C. RAJAN

B.Sc., B.T., M. WOOD TECH. (MICH., U.S.A.), P.G. DIP. FORESTRY, ETC.

I.F.S. (RETD)

FOREWORD BY

PROF DR. B.R. SESHACHAR,

Formerly President, Indian National Science Academy

The book is comprehensive, easy to read, covers all aspects of Eucalyptus cultivation and utilisation.

BOOK SIZE : Demi 1/4, 275 Pages with 40 Photographs, 163 Tables, 200 References, Beautiful Cover with Colour Photographs. For copies write to :

DIANA PUBLICATIONS,
76, NANDIDURG EXTENSION, BANGALORE-560046. INDIA.

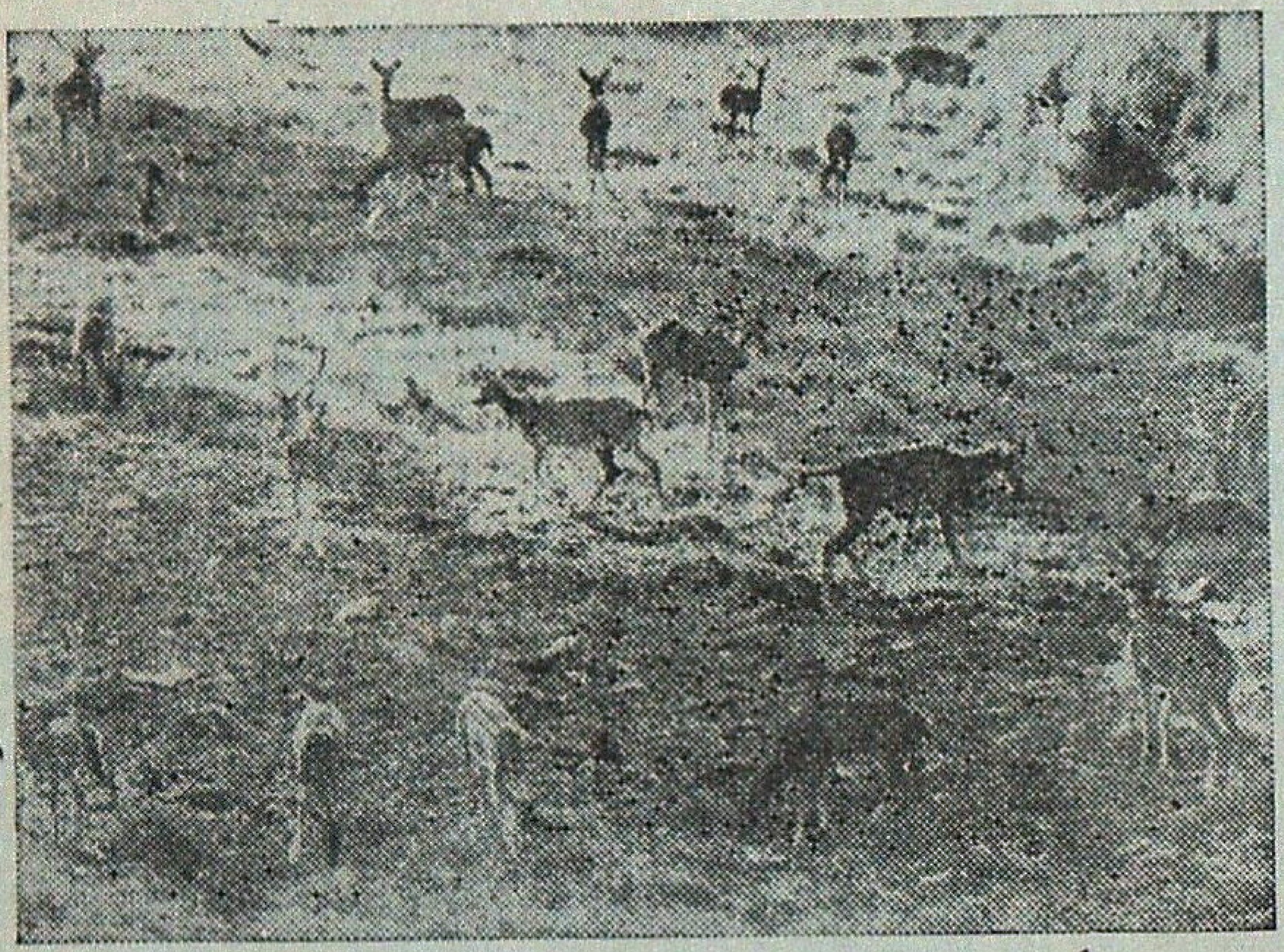
COST OF BOOK : Rs. 160-00 or US $ 25/-. All outstation cheques should include Rs. 6/- or US $ 2/- towards Bank charges. All demand Drafts shall be payable at Bangalore Please add Rs. 15/- or US $ 11/- for Packing Forwarding and Registered Postage charges per book. For Bulk Orders, deliveries will be effected by carriers at your cost. Our responsibility ceases on Mailing or on handing over to the carriers. Books can also be sent by VPP within India.

When you are at leisure, and wish to come close to nature

PLAN A VISIT TO :

TADOBA NATIONAL PARK

The oldest wildlife resort of Maharashtra (Vidarbha) (Area 625.32 km²) and Enjoy Nature at its Best.



- The Park is rich in wildlife and offers excellent opportunities for nature viewing and Wildlife photography.
- Besides, plenty of Chitals, Sambhars, Barking deers, Chousingha, Nilgai and Bisons; the Tigers, Panthers and Wild dogs also occur in sufficient numbers and provide good chances of sighting during observation treks and rounds.
- The habitats are rich in Avifauna and eagles, kestrels, kites, orioles peafowl, partridges, quails, teals and Jacanas would not miss the sight normally.
- Limited facilities for accomodation are available and therefore contacting in advance is essential.
- The Park remains open throughout the year, but movement in the Park is restricted, between sunset and sunrise every day.
- Nearest railway station; Chandrapur (M S) - 45 Kms.
- Nearest Airport; Nagpur 160 Kms.

For further details contact :
Divisional Forest Officer,
Tadoba National Park,
Behind Rambag Nursery,
Chandrapur 442 401 (Maharashtra).
Phone : Off. 3414, Res. 2382.

WE ARE IN THE MARKET FOR TREE AND SHRUB SEEDS OF ALL KINDS
KRISHI VYWASTHA
FOREST SEED SUPPLIER
366; JHORI BAZAR, JAIPUR-3 (RAJ)
PHONE : O-40937 R-41506

NINE YEARS OF ACHIEVEMENT : NINE YEARS OF PROGRESS

Madhya Pradesh Rajya Van Vikas Nigam Limited

Rededicates itself for rehabilitation of Green-Glory :

* 52450 ha of Teak plantations
* 16101 ha of Bamboo plantations
* 1586 ha of Tropical pine plantation
* 2013 ha of Industrial plantations
* 27486 ha of afforestation under Drought prone Area Programme
* 334 ha R K M. length of Avenue plantations.

Modest contribution to setting up of Forest-based industries :

* Bastar Wood Products, Jagdalpur—a joint venture
* Narmada wood Products, Itarsi—our sole enterprise
  Supply of Sal sleepers to Indian Railways
* Wood Working Centres to impart-skill to rural artisan
* Initiating an ambitious programme for industrial plantatians in joint sector.

Annual Employment generation ... ... 100 lakhs mandays.
Annual Wage distribution ... ... 900 lakhs
Cumulative expenditure on labour welfare activities Rs. 36.50 lakhs

With best Compliments from ;
MANAGING DIRECTOR
M.P. RAJYA VAN VIKAS NIGAM LIMITED
PANCHANAN, MALVIYA NAGAR,
BHOPAL (MADHYA PRADESH)

The Moments of Life Time Experience await you

IN SASAN-GIR

you have a date with the

King & Queen

of Animal World

The most Majestic Royal
Animal species—

The Rare
Asiatic Lion

For more details contact :
Deputy Conservator of Forest,
Wild Life Division,
P.O. Sasan-gir - 362 135
Distt. Junagadh, Gujrat.

WUDGARD

THE NEW NAME IN WOOD PRESERVATIVES

- **WUDGARD** For All Applications—In Homes, Factories, Transmission Poles, Industrial Products, Packages.
- **WUDGARD** Can be Applied By Dipping, Brushing, Spraying or Pressure/Vacuum Impregnation As Per IS : 401 Specification and Some Sophisticated Grades For Special Care.
- **WUDGARD** Wood Preservatives, manufactured in India by

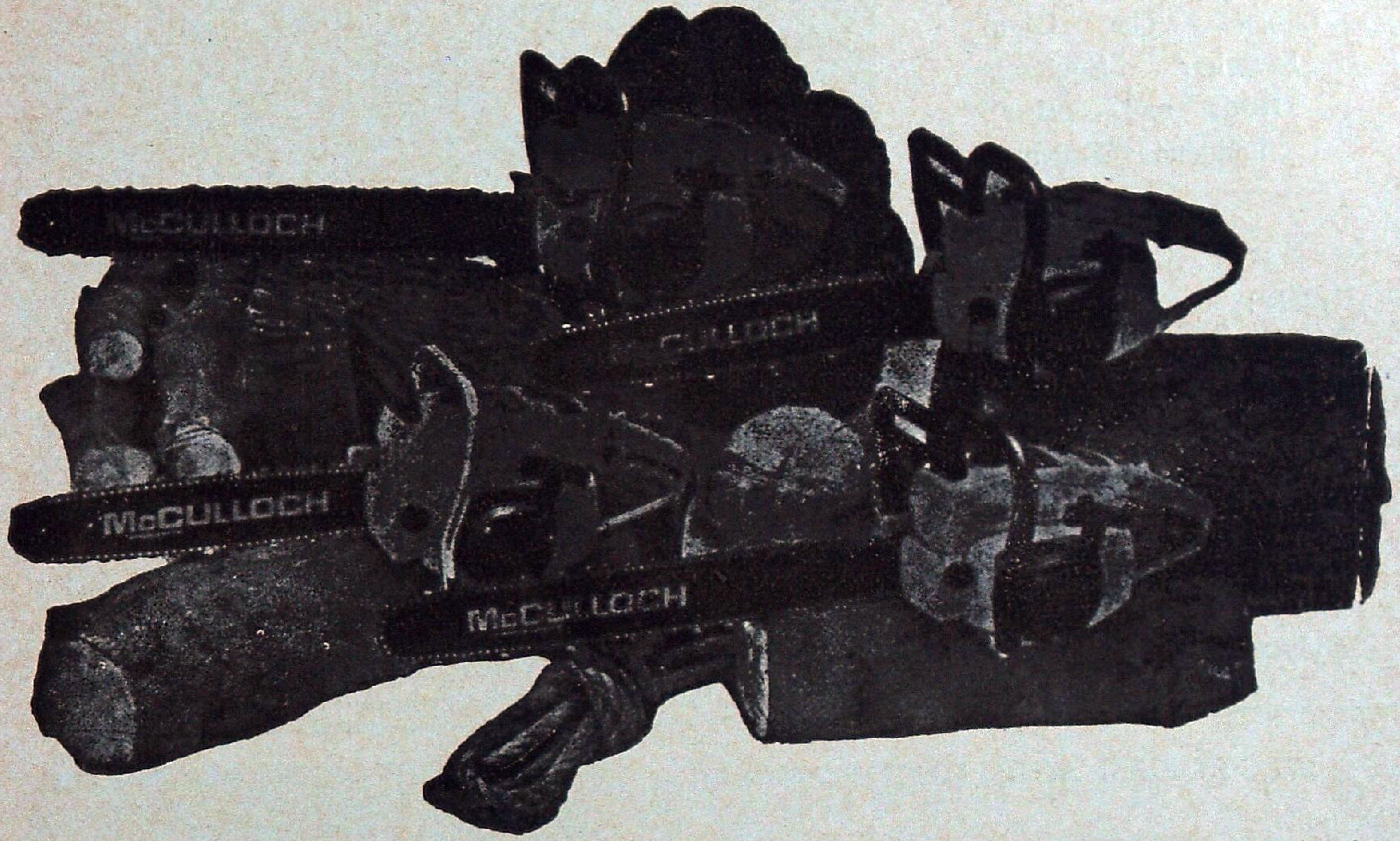
Castrol

INDROL Lubricants & Specialities Ltd.
Head Office: 91, Walkeshwar Road, Bombay-400 006
Branches at Bombay, Calcutta, Delhi and Madras
Depots and Consignment Stockists—All Over India

NORVICSUM

AVAILABLE IN INDIA FOR THE VERY FIRST TIME
WITH CHAIN BRAKE ATTACHMENT

McCulloch. The Professional Dealer Choice



The worl 's best power chain saws made by "McCULLOCH CORPORATION" Los Angles California, U.S.A., the most experienced people in the field. McCulloch's the NUMBER ONE SELLER of Chain Saws in the world.

SPECIAL FEATURES :

1. Rugged Dependability.
2. Easy Maintenance.
3. Economical in operation.
4 Best Combination of Bar, Chain & Sprocket.
5. Capable of cutting any type of HARD WOOD even harder than concrete.
6. Bar length available 24", 28" & 32".
7. All essential spares are readily available.

McCULLOCH CORPORATION exclusive features only on McCulloch Saws :

"Faster cutting with less effort in all type of timber".

"Safe-T-Starter".

Snap – lock air filter cover.

"Chain Brake safety feature stops moving chain in miliseconds to reduce the hazards from kick back".

Please contact : "SOLE DISTRIBUTORS in India".

M/s. Indiana International

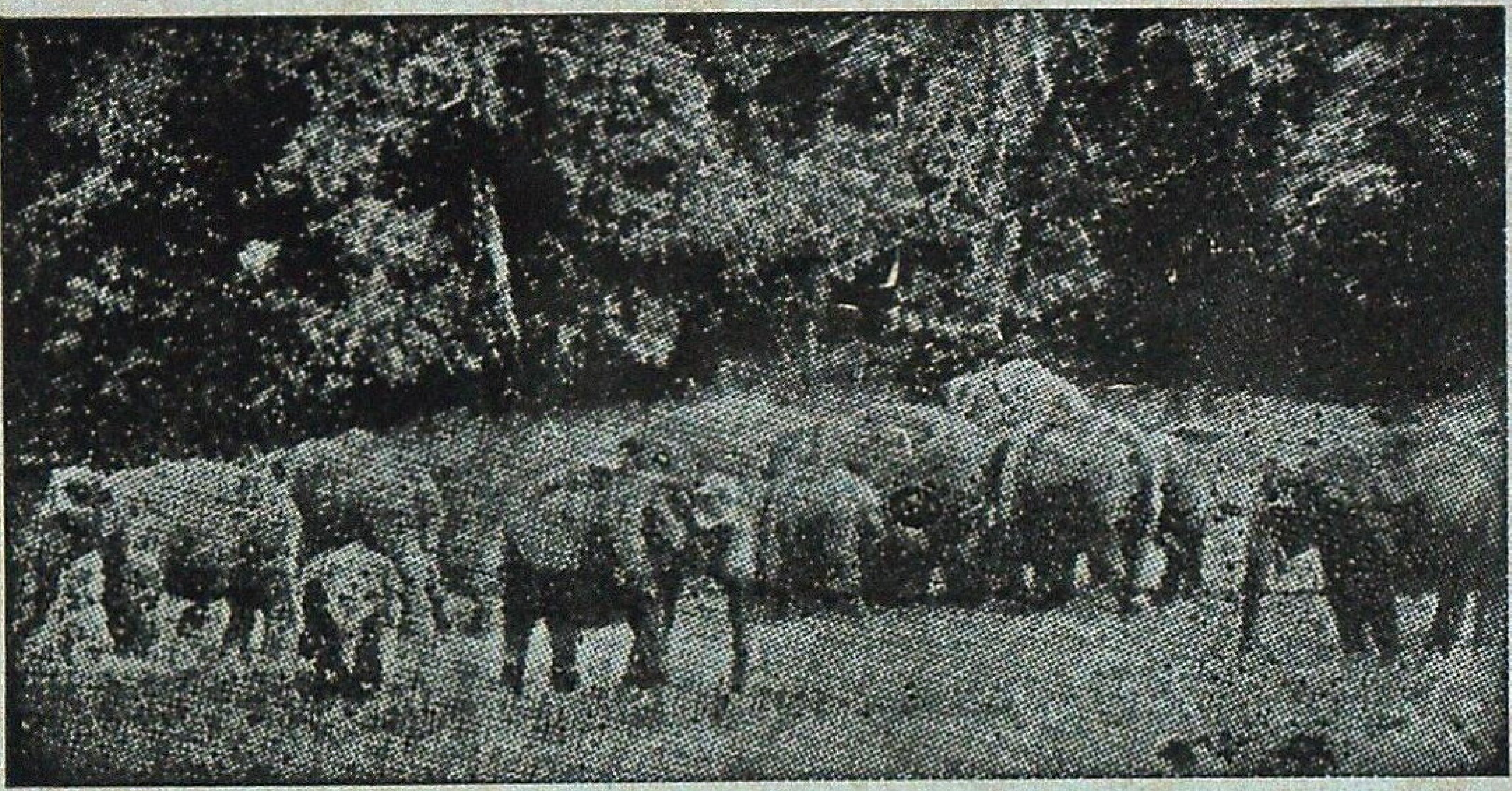
2001, Ugger Sen Street, Bazar Sita Ram, Delhi-110 006
Phone : Office : 734868, Resi. : 224-2737 Gram : "POWERCHAIN"
Res. Address : F-42, PREET VIHAR, DELHI-110092

VISIT **PERIYAR TIGER RESERVE**

THEKKADY (KERALA STATE)
(OPEN ALL YEAR)

OBSERVE

Elephants, Gaur, Sambhar Leopard, Wild Dogs, Black Langur, The Giant Malabar Squirrel, Birds and other indigenous Fauna.



—

Hotels :
Western Style—Aranya Nivas
Indian Style—Periyar House.
(Accommodation in Hotels reserved by Managers)
†Frunished Forest Rest Houses at Thannikudy, Mullakudy and Manakavala.
†Motor Boats available for most enjoyable cruise in the lake.
†Elephant rides.
†Approachable by Air or Rail up to Cochin or Madurai.
Distance to Thekkady by roads is 190 km from Cochin, 145 km from Madurai and 110 km from Kottayam.

For further particulars contact :—WILD LIFE PRESERVATION OFFICER
Thekkady P O., (Kerala) Telephone : KUMILY 27

FOR ROPING AND PLANTING TREES

POLYTHENE BAGS

GUSSETTED-PERFORATED OR PLAIN

Contact for Immediate Supply

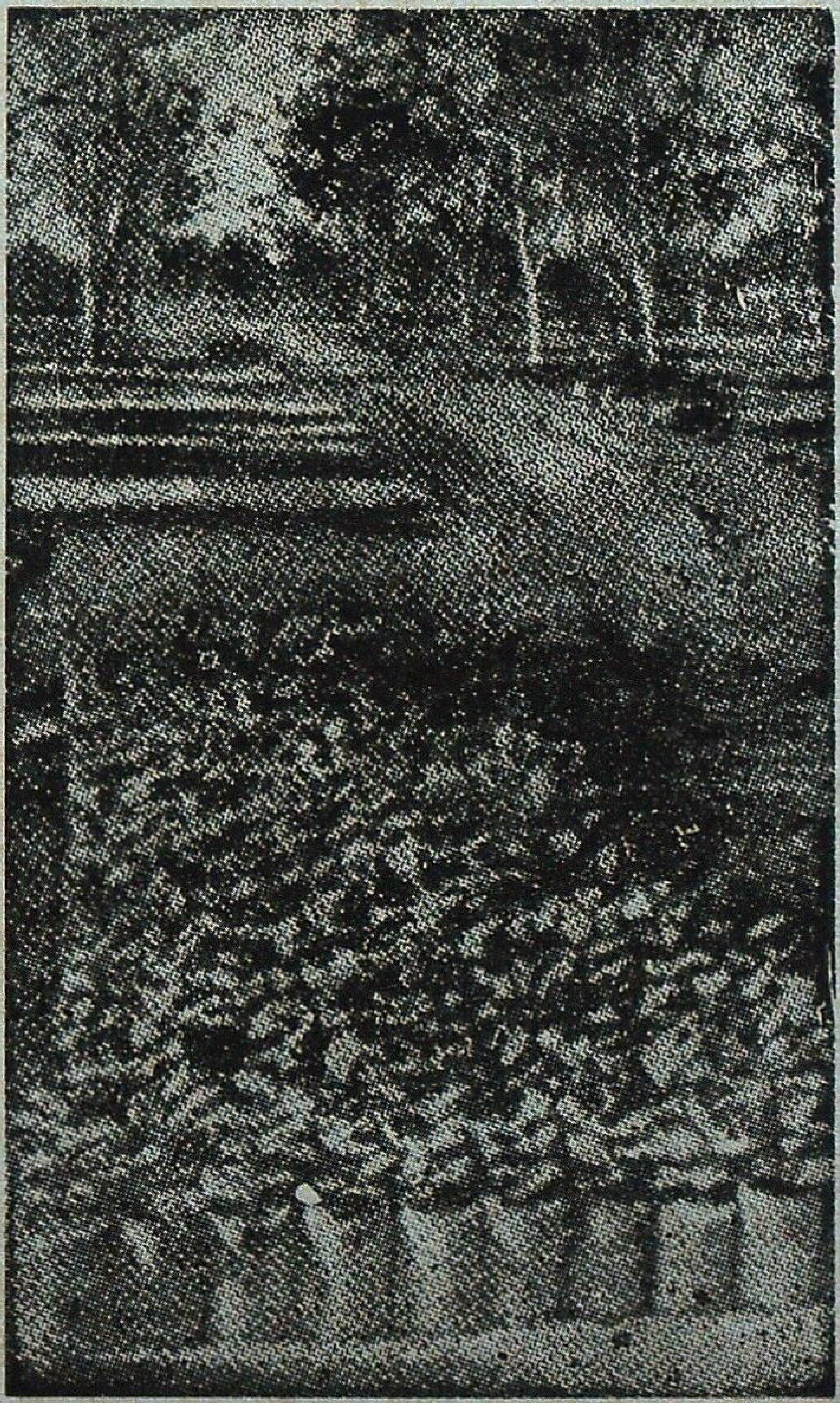
KANPUR PLASTIC COMPANY

111/423, Ashok Nagar, KANPUR-208 012

Phones { Office : 243721 & 244992
Resi. : 245954 Gram—KANPLASTIC
Fac. : 244993 Estd.—1956

———

ALL SIZES OF POLYTHENE BAGS IN REQUIRED GAUGE & SPECIFICATIONS AVAILABLE



ONE UNIT PLYWOOD
EQUALS
Three Units Sawn Timber
Use Plywood and Conserve Timber

★

THE INDIAN PLYWOOD MFG. CO. LTD.

9, WALLACE STREET, FORT,

BOMBAY-400 001 (MAHARASHTRA)

FACTORIES AT : DANDELI, DHARWAD, TALAGUPPA,

SUBRAMANYA AND HUNGARCUTTA.

VISIT : Palamau National Park

Famous for the abundance and variety of wildlife—Tiger, Panther, Elephant, Gaur, Samber, Spotted deer, Barking deer and numerous species of beautiful birds,

Picturesque Scenery.

*A place of historical importance the
*old and the new Palamau Fort of Chero Kings.

*Ideal holiday resort.

*Well furnished tourist Lodges and Forrest Rest Houses with catering arrangement.

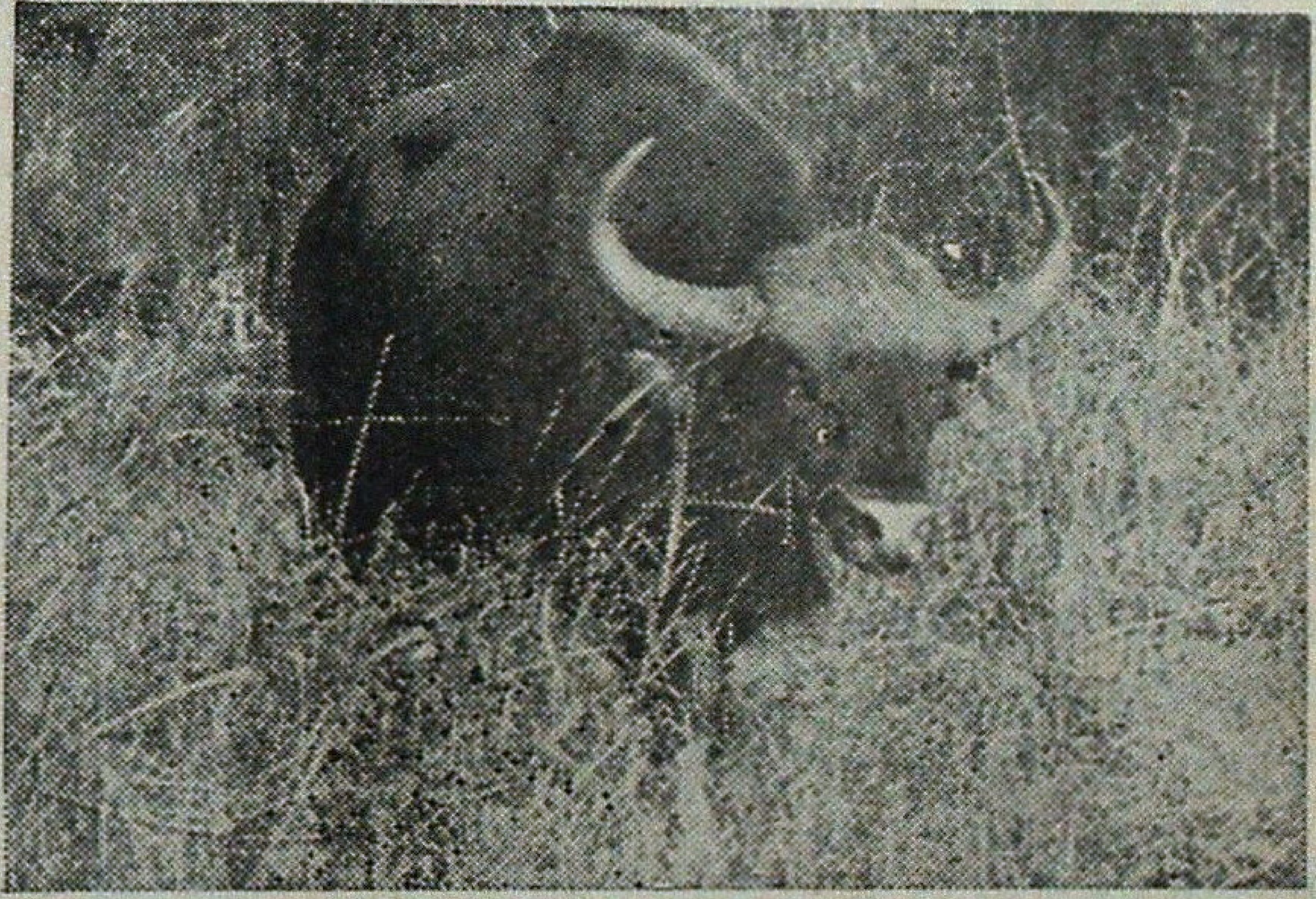
*Beautiful Watch Towers, tree-top and Hide-outs-all connected by roads.

*Remains open throughout the year.

*Snaps and movie permitted free of charge.

*Approachable by road and rail–26 kms from Daltonganj 12 kms from Chhipadohar Rly. Station. Well connected by roads with comfortable Bus service.

Nearest Airport—Ranchi –175 kms.



For further particulars write to :

THE FIELD DIRECTOR, PROJECT TIGER,

Palamau Tiger Reserve,

P.O. Daltonganj, Bihar, (India)

We have pleasure to introduce ourselves as :

* Producers of Round Timber for Veneering and Saw Mill.
* Manufacturers of Tea chests and Commercial Plywood.
* Suppliers of Sawn Timber and Furniture.
* Cultivators of Coffee, Cardomom, Rubber, Cocoa, Tea and other cash crops.
* Manufacturers of Match and Polythene Bags.

Arunachal Pradesh Forest Corporation Limited

(A Govt. of Arunachal Pradesh Undertaking)

DEOMALI

Regd. Office :
ITANAGAR—791 111
Distt. Sabansiri
(Arunachal Pradesh)

Head Office : -
P.O. DEOMALI—786 629
Distt. Tirap
(Arunachal Pradesh)

FOREST DEVELOPMENT CORPORATION OF MAHARASHTRA LIMITED, NAGPUR.
(A Govt. of Maharashtra Undertaking)
We produce in bulk

Quality teak for plywood, veneering and saw milling.
Valuable non-teak logs and poles for various use.
Bamboos.
Firewood.
Industrial grade charcoal,
Khair wood & Ain bark.

For particulars, contact :—
The Regional Manager,
Forest Development Corporation
of Maharashtra Ltd., Nagpur-440010

Associate yourself with the

INDIAN FORESTER

as

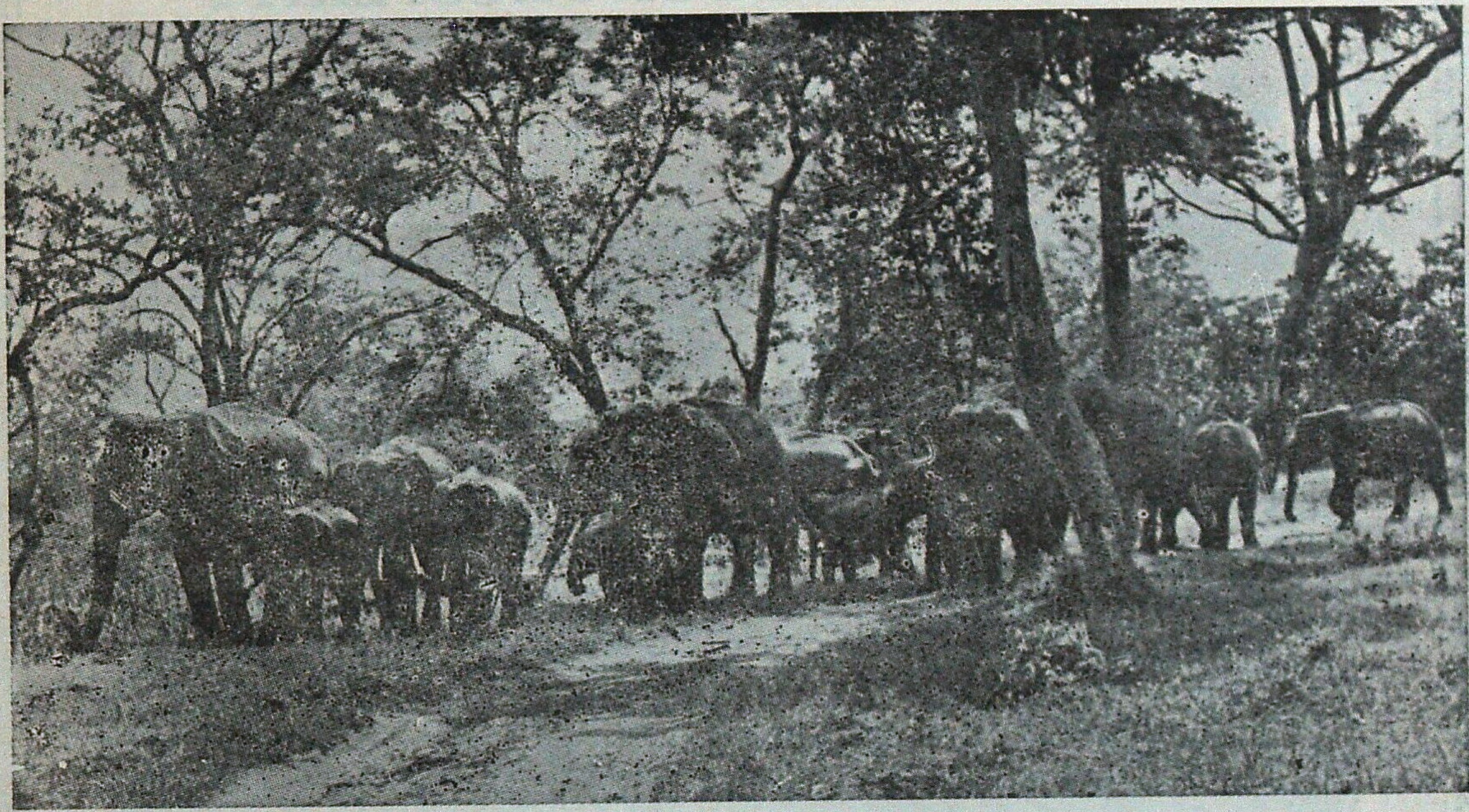
Advertiser—Subscriber

or

Contributor

BANDIPUR TIGER RESERVE

KARNATAKA



Lovers of nature and Wildlife the world over find it well worth their while to linger on in Bandipur. More famous as a Tiger Reserve, Bandipur enjoys reputation as a wildlife sanctuary that stretches as far back as 1931. The Mysore Maharajas; benign rulers and farsighted visionaries understood the compelling necessity of protecting the fauna, avifauna and flora from the thoughtless foreys of marauders. Today 874 sq kms. of the Bandipur National Park makes up the Tiger Reserve which is one of India's finest parks.

But Tigers, native to the country and the most magnificent of the great cats are saved from threatened extinction. An abundant variety of fauna: the panther, wilddog, Sloth bear, Sambar, Chital, barking deer, fourhorned antelope, common langur; avifauna like peacock, grey jungle fowl, crested hawk, eagle and reptiles such as crocodiles, Python, Vipers, etc., roam this park freely.

Hundreds of spotted deer greet the visitors right at Bandipur campus, at night times as they step out of comfortable cottages.

A herd of elephant majestically moving single file through a patch in the jungle can be viewed on an elephant ride. If one is lucky he can watch in absolute silence, of course – a herd of Indian 'bison' or gaur, locking horns a few meters away.

Nature at its bountiful best—Bandipur bestows the soothing solace of jungle retreat off the beaten track and far from the madding crowd.

For further particulars, please contact

The Field Director
'Project Tiger'
Government House Complex
MYSORE—570 010
(KARNATAKA—STATE)—INDIA
Telephone No. 20901

GROW POPLARS FOR PROSPERITY

And you will help ameliorate the environment too.

The **WIMCO-NABARD** Farm Forestry Project in U.P., Punjab and Haryana offers you the benefits of combining forestry with farming to increase your returns.

WIMCO provides:

* *High quality planting material of selected Poplar clones*
* *Extension services and technical guidance till harvest*
* *Assistance in securing bank loans and insurance cover for Poplar trees*
* *Buy back guarantee at assured minimum price at 8 years rotation.*

Over 2,442 farmers have already planted almost 25 lakh Poplars till February, 1987

For details write to

WIMCO

WIMCO LIMITED

- B-4/15, Vasant Vihar, New Delhi-110057. Ph. 675194
- A-532, Lajpat Nagar, Moradabad-244001. Ph. 27992.
- B-9/35, Rampur Garden, Bareilly-243001. Ph. 72081
- 843, Sector 13, Urban Estate, Karnal-132001.
- 4, School Road, Yamunanagar-135001. Ph. 28313
- 224, Sector 18-A, Chandigarh-160018. Ph. 20558

Himachal Pradesh State Forest Corporation Ltd.

(A Govt. of Himachal Pradesh Undertaking)

HPFSC marches ahead towards a better tomorrow under the dynamic guidance and leadership of Hon'ble Chief Minister Shri Vir Bhadra Singh.

Himachal Pradesh State Forest Corporation has taken long strides under the benevolent guidance of our Chairman Prof. Chander Kumar, Hon'ble Minister of State for Forests.

* With complete nationalisation of forest working viz; timber operations, resin tapping etc. both in Govt. and private forests, there is complete elimination of contractor' agency. Modernisation of timber operations has reduced conversion wastage considerably and the incidence of organized illicit felling in forests is completely under control.

* To ensure gradual reduction in use of valuable coniferous timber for packing cases, effective steps have been taken for distribution of Card Board Cartons and purchase of Wooden Packing Cases from adjoining States of Punjab and Haryana.

* Stocks of timber extracted by Corporation are being supplied towards developmental works by catering to the requirements of Indian Railways, Director General of Supplies and Disposals, Defence Organisation and other Govt. Indenters. Sale of timber stocks is being organized through well established sale depots conveniently located.

* The annual turn-over has registered a significant increase from its inception from 1974-75 being Rs 2.43 crores to Rs. 44.83 crores in 1986-87.

* In order to maximize operational efficiency, following steps have now been initiated :

a) Replacement of old fleet of trucks for minimising transportatton time of timber to depots;

b) Analysis of financial data through computer net-work to ensure prompt and efficient working.

c) Providing incentives to officers and staff through prompt action on service matters like confirmations, job rotation vis-to-vis career planning including specialized training.

(V.P. Mohan)
Managing Director.

NOW
AVAILABLE
ISI MARKED,
FLUSH DOORS
(Solid core type)
Commercial
&
Decorative

Why look for
solid timber for your doors & windows ?
use
rain water & insect resistant. Phenol bonded.
BLOCK BOARD & FLUSH DOOR
for longer life, strength and durability at a much cheaper cost.

AVPL

ALOKUDYOG VANASPATI & PLYWOOD LTD.
Authorised Controller :
WEST BENGAL FOREST DEVELOPMENT CORPN. LTD.
(A GOVT. OF WEST BENGAL UNDERTAKING)
6-A, RAJA SUBODH MULLICK SQUARE, CALCUTTA-700 013

GRAM : VANUDYOG PHONE : 26-5226

TO LET

MUDUMALAI WILDLIFE SANCTUARY

MADRAS STATE

Best Visiting Time: APRIL—JUNE

40 miles from Ootacamund and 60 miles Mysore
connected by Public Bus Service

Nearest Airport: COIMBATORE
Nearest Railway Station: OOTACAMUND

Noted for variety wildlife and Picturesque Scenery, ideal Holiday resort

Fully Furnished Forest Rest Houses
Cooks attached, Meals served on
Advance Booking and
Elephant and Jeep for Joy Rides available.

For Reservation & other Particulars write to:

WILDLIFE WARDEN
Mudumalai Sanctuary,
Coonoor Road, Ootacamund-1

An indispensable reference book for botanists, forest officials, environmentalists, phytochemists and others

Name changes in Flowering Plants of India and Adjacent Regions

By

Dr. S.S.R. Bennet

Pages 772 + xiv. published in 1987

Price Rs. 480.00 US $ 60.00.

Name changes in plants is a major problem for all those who are interested in plants. Due to the non availability of sufficient taxonomic literature in most of the colleges & research institutions, the teachers & scientists face difficulties in finding the correct names and relevant synonyms of plants. To collate the information available, studies done on a plant in various parts of the world it is essential to know the presently accepted correct name & the other names which apply (synonyms) to that plant.

This book, which is a consolidated account of name changes of 5175 FLOWERING PLANTS OF INDIA AND ADJACENT REGIONS, is a useful reference book for teachers of botany, scientists of various disciplines engaged in the study of flowering plants, foresters, environmentalists & others to find out the presently accepted correct names & relevant synonyms of plants of India.

10% discount for the orders from institutions
Books will be sent by V.P.P.
Packing and Postage free

For copies please write to :

Triseas Publishers

94-A, INDIRA NAGAR COLONY,
DEHRA DUN - 248 006
(U.P.) INDIA.

"This most useful book, giving the current botanical names of 5175 flowering plants of India and regions around, fulfils a long-felt need of forest botanists, economic botanists, ethnobotanists and phytochemists".

—REVIEW
INDIAN FORESTER
APRIL, 1987.

CHHATTISGARH INVESTMENTS LTD.

Regd. Office: 8/9, Industrial Area, Raipur (M.P.)

: FORESTERS AND INVESTORS :

INVITES

(1) Applications for the following :

A. Field Officer

B. Research Scholars

(2) Catalogue and Price List from Seed Suppliers.

(3) Catalogue and Price List with trade terms from Publishers of books on Forestry and Medicinal Plants.

(4) Allied information, technical datas and suggestions from all concerned.

OFFERS

(1) Seedlings of *Eucalyptus* hybrid and Subabul for plantation in 1988.

KARNATAK STATE FOREST INDUSTRIES CORPORATION USHERS IN THE PROGRESSIVE ERA FOR FOREST PRODUCE !

Ecological imbalance is one of the most important hazards enveloping our Country.

In Karnataka, K.S.F.I.C. is progressively involved in eliminating this hazardous element by undertaking scientific logging operations and helping erase the contract system. So that there exists a cleaner and healthier environment around us.

KSFIC's long standing activities consist of :

Supplying L.D.P.E. Polythene bags/sheets for nurseries of the Forest Department, Corporations, Local Bodies, Zilla Parishads, Packers, etc.

Regular Public auctions of sawn timber in various sizes for builders, Merchants, Contractors, etc, from their saw mills at Dandeli and Shimoga.

Supplying treated sleepers to the Railways and treated wooden poles to the Electricity Board from their Wood Preservation Plants at Shimoga and Mangalore.

Supplying high quality handlooms for the weaving industry fabricated at Shimoga and Dandeli saw mills.

Fabricating and supplying furniture to Government Departments, Corporations, Societies and Institutions. Furniture orders are also accepted.

Supplying Firewood at reasonable rates to the common man from 51 firewood depots. Solar and steam heated seasoning kilns have been built by KSFIC for seasoning timber at subsidised rates, thus encouraging the practice of seasoning wood before use.

Soon, KSFIC will diversify to market Flush doors and Block Boards from its manufacturing unit at Bangalore. It also has plans of marketing pulverised sandalwood powder from sandalwood white chips and spent wood in the immediate future.

THE KARNATAK STATE FOREST
INDUSTRIES CORPORATION LTD.
32/2, Crescent Road,
Bangalore—560 001
Ph. : 29611 Grams : INDFOREST

TAFCORN

Stands for Quality Products

Pulpwood, Cashewnuts, Sandalwood Oil, Sandalwood Powder and Chips, Picture Varnish, Shellac Glue, Shellac Compound, French Polish, Thinner, Honey etc.

For your requirements, Please contact:

Managing Director,
TAMIL NADU FOREST PLANTATION CORPORATION LIMITED,
(A Government of Tamil Nadu Undertaking)
34/A, Promenade Road,
Cantonment, Trichy-620 001

ENJOY your Holidays in Orissa

The place that will enchant you most is
NANDANKANAN
With its
SYLVAN SURROUNDINGS

BEAUTIFUL LAKE and boating toy train, elephant ride,

INDIAS' LARGEST LION SAFARI in natural environment.
White tigers, black panthers, varieties of deer, bear, South American green Iguana, rhinos, gibbon, monkies, crocodiles and birds.
Foı details please contact :

The Director
Nandankanan Biological Park, Orissa,
145-Saheed Nagar, Bhubaneswar-751007
Phones : Off-53840, Res. 53660, Park-51580

WILDLIFE ORGANISATION
FOREST DEPARTMENT-ORISSA

ROSEWOOD/TEAK

WE CAN SUPPLY :

- Veneers (decorative) of Rosewood, Teak, White Cedar etc.
- Rosewood Guitar Finger Boards, Guitar Neck, Billiard Cues, Knifehandles, Parquet floor tiles, Guitar quality veneer, etc.
- Any quantity of Kiln seasoned sawn sizes of Teak, White cedar, Anjily etc
- Factory made doors (Frames and shutters), windows, ventilators of Teak, Anjily, Pillamaruthu, Venteak and Malaysian timber species. Also plywood and particle board panel inserts in wooden shutter frames.
- Decorative doors of Rosewood, Teak and White cedar.
- Veneers (commercial) of Pali, Punna, Karanjily, Silver oak, red cedar etc.
- Core and lipping material for flush doors.

For details contact :

Managing Director,
KERALA STATE WOOD INDUSTRIES LIMITED,
P.O. Box No. 9, Nilambur 679 329, Malappuram, Kerala.
Phone : 378, 254.

OR

Marketing Manager,
KERALA STATE WOOD INDUSTRIES LIMITED,
'Karunalayam' Wynad Road, Calicut 673 001, Kerala.
Phone : 62629 and 61113,
Telex 0804-246 KWIL IN, Gram : 'WOODLAND'

SALE SALE SALE

A few copies of the following **SPECIAL ISSUES** of the *Indian Forester* are available for sale :

January, 1975	—	Indian Forester Centenary Issue.
September, 1983	—	Poplar – I
October, 1983	—	Poplar—II
September, 1984	—	Biomass – II
November, 1985	—	International Year of the Forests
December, 1985	—	Eucalyptus – IV
July, 1986	—	Brandis Memorial/Environmental Conservation
October, 1986	—	Wild Life

The cost of each issue is Rs. 20.00. Forwarding charges per copy will be Rs. 10.00 extra. In case you intend to purchase any of these issues before the stock is exhausted, kindly send your order together with the relevant payment to :

The Business Manager :
INDIAN FORESTER,
P.O. New Forest, Dehra Dun–248006
(India)

RULES OF CONTRIBUTIONS

1. Contribution should be sent to the Honorary Editor, *Indian Fo ester*, Forest Research Institute, P.O. New Forest, Dehra Dun, or to any Member of the Board of Management or Central Editorial Board and should be written legibly in ink *preferably* typed.

2. The Central Editorial Board does not hold itself responsible for the opinions expressed by the authors.

3. The Central Editorial Board reserves the right of accepting or rejecting any contribution and of making suitable alterations and amendments, without assigning any reason.

4. Contributors are invited to sign their contributions in preference to affixing to them a *nom de plume*, since professional opinion naturally carry more weight when their author is known. All communications must be authenticated by the name and address of the writer being communicated to the Honorary Editor, whether intended for publication or not.

5. Contributors will be supplied with 30 extra copies of their contributors, together with any illustrations accompanying them. free of charge. Additional copies will be charged for at the rate of twenty paise per page per reprint. *Contributors desiring extra copies should state the number of reprints required when sending articles, otherwise they will not be available.*

6. No payments will be made to members of Govt. organisation for their contributions to the *Journal* but it will be open to the Honorary Editor, to make payments for articles accepted from the outside public.

INSTRUCTIONS TO CONTRIBUTORS

Title—This should be brief, carefully chosen, and indicative of the contents of the article. It should be inserted on the top of the first page in block capitals.

Authors—The name of the author and his status should appear immediately under the title, but need not be entirely in capitals.

Introduction—An introduction presenting the general object of the work, and the scope and importance of the problem is, desirable.

Presentation—The matter should be neatly written, or typed double or treble spacing, on one side only of fullscape size paper with a left hand margin of 4 cm and margins of 2.5 cm at the top and bottom of each page except the opening page where the top margin should be 4 cm. The sending of the contributions in triplicate is recommended.

Summary—A condensed account of the important contents of the article should be at the end of article. The summary should be self-explanatory, complete and clear in itself, avoiding, as far as possible, technicalities.

Illustrations—The number of illustrations should be kept at a minimum as their reproduction is costly. Photographs and drawings should, if possible, be made to the correct proportion of the printed page of the magazine (20 cm by 15 cm). Nothing should be written in pencil or ink, or type-written on the back of illustrations as they cause trouble in reproduction. Photographs and illustrations should not be pinned or swen with thread as such pine holes reproduce in photography. The former should be in black and white, with pronounced contrasts and glossy finish; the later should be neatly drawn in Indian ink on white thick paper or drawing paper. Graph paper should preferably have black co-ordinate lineson white background. Captions should be typed or written on separate strips of paper and attached with colourless adhesives to the back of the prints. The approximate place where the illustrations are to be inserted should be indicate in the text, and the illustrations should be serialy numbered. In mailing illustrations should be placed between cardboards held together by thin thread or rubber bands.

Copyrighted pictures or photographs from commercial photographers should not be sent.

Punctuations—Authors should pay special attention to punctuation as this greatly aids the reader in understanding the author clearly; if this is left to the editor, a wrong punictuation made by him may alte the author's intended meaning of a sentence.

Citations—The Bibliography should be given at the end of the article on separate sheet of paper and should be typewritten double-spaced throughout. Reference to a citation in the text should be made by means of the author's name followed by a reference number in parentheses. In the bibliography the ctartion should be preceded by the reference number. The citation will consist of the serial number, the autho sof name and initials (in large and small capitals), the year of publication, the title of the article, the titls'ari the book, paper or periodical, volume number and date of issue and the page numbers, thus:

Hamilton, A.P.F., (1947). Farm Forestry in India. *Indian For.*, 74 (3), 84–88

Corrections—Authors are requested to see that their typescripts incorporate all corrections they desire to be carried out as no revisions are permitted by the press in the proof stage and any resetting involves heavy cost.

Capitals—Normally, typewritten or handwritten matter should show where capitals are to be used. If a whole wordor line has to be printed entirely in capitals the original should also be so written. To indicate italics a single straight line should be drawn under the matter concerned in the original text. For detailed instructions see the editorial in the *Indian Forester* of May. 1950

30 4 1987

THE INDIAN FORESTER

VOLUME 113 SEPTEMBER, 1987 NUMBER 9

Aerial spraying by fixed winged aircraft Bever against Deodar defoliator in Kamraj Forest Division, Jammu & Kashmir.
Photo - M.D. Dhoundiyal ... Front Cover

CONTENTS

ARTICLES

Changing concepts of Forestry in India. G.P. Maithani 593

Herbaceous undergrowth in some Forest Habitats in Nilgiris.
Rashmi Rajvanshi, Vijai Kumar, Waman Bachpai, K. Rajagopal and S. Francis Hilary Raj 995

Effect of clear-felling of congested clumps on yield of Bamboo (*Dendrocalamus strictus*). Ram Prasad 609

Litter fall and natural regeneration of Spruce and Silver fir.
Virendra Singh, S. Bhagat and S.R. Arya 616

Sundarbans Mangroves - Biomass productivity and resource utilization an indepth study. Kalyan Chakrabarti 622

Studies on variability and association of yield and its components in *Solanum elaeagnifolium* Cav. K.R. Khanna and S.P. Singh 629

Ethnobotanical studies on some plants of Burnihat Valley, Assam/Meghalaya.
Sas Biswas and A. Ahmed 634

Bird activity and Seed productivity in the Coral tree, *Erythrina indica*.
H. Daniel Wesley 640

RESEARCH NOTES 648
LETTER TO THE EDITOR 652
OBITUARY 653
GAZETTE NOTIFICATIONS 654

CENTRAL EDITORIAL BOARD

R.V. SINGH, I.F.S. (*President*), G.P. MAITHANI, I.F.S. (*Hony. Editor*)
P.P. MALHOTRA, I.F.S., P. KESWANI, I.F.S.
Dr. RAMESH DAYAL

Edited by G.P. Maithani, I.F.S., Honorary Editor, Indian Forester (Director, Forestry Research, Forest Research Institute & Colleges, Dehra Dun), Published by R.N Biswas, I F.S, Business Manager, Indian Forester, (Senior Research Officer, Documentation and Bibliography Sec., Silviculture Branch, Forest Research Institute & Colleges, Dehra Dun) and Printed by S.K. Arora at Print World, Dehra Dun.

Registered No. **D.N. 36**